9-2320-230-20

TM 9-2320-230-20

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE MANUAL
FOR
TRUCK, CARGO: 5-TON, 8X8, M656 W/WINCH (FSN 2320-999-8481)
TRUCK, CARGO: 5-TON, 8X8, M656 W/O WINCH (FSN 2320-903-0883)
TRUCK, TRACTOR: 5-TON, 8X8, XM757 W/WINCH (FSN 2320-937-1846)
TRUCK, TRACTOR: 5-TON, 8X8, XM757 W/O WINCH (FSN 2320-937-1445)
TRUCK, VAN, EXPANSIBLE: 5-TON, 8X8, XM791 W/WINCH (FSN 2320-832-5619)
TRUCK, VAN, EXPANSIBLE: 5-TON, 8X8, XM791 W/O WINCH (FSN 2320-832-5620)

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

APRIL 1969

READEX FICHE best copy available

Reproduced from poor document.

D101.11:

CHANGE
No.. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 *January 1971*

Organizational Maintenance Manual

TRUCK, CARGO: 5-TON, 8x8, M656 W/WINCH
(FSN 2320-999-8418)

TRUCK, CARGO: 5-TON, 8x8, M656 W/O WINCH
(FSN 2320-903-0883)

TRUCK, TRACTOR: 5-TON, 8x8, XM757 W/WINCH
(FSN 2320-937-1846)

TRUCK, TRACTOR: 5-TON, 8x8, XM757 W/O WINCH
(FSN 2320-937-1445)

TRUCK, VAN, EXPANSIBLE: 5-TON, 8x8, XM791 W/WINCH
(FSN 2320-832-5619)

TRUCK, VAN, EXPANSIBLE: 5-TON, 8x8, XM791 W/O WINCH
(FSN 2320-832-5620)

TM 9-2320-230-20, 16 April 1969, is changed as follows:

Page 1-4. Paragraphs 1-4 *b* (3) and (8) are changed as follows:

(3) Turbocharger

Make	Schwitzer
Part Number	11641831

(8) Fuel injection pump

Make	American Bosch
Part Number	11641907
Operating Range	650 / 2800 rpm

Page 2-1. Table 2-1 is changed as follows:

Compound antifreeze
Artic 2

Issued full strength and ready mixed for —40° F. to —65° F. temperatures for Arctic use for both initial installation and replenishment losses. DO NOT DILUTE WITH WATER OR OTHER SUBSTANCE.

Page 2-3. **Figure 2-1 is superseded as follows:**

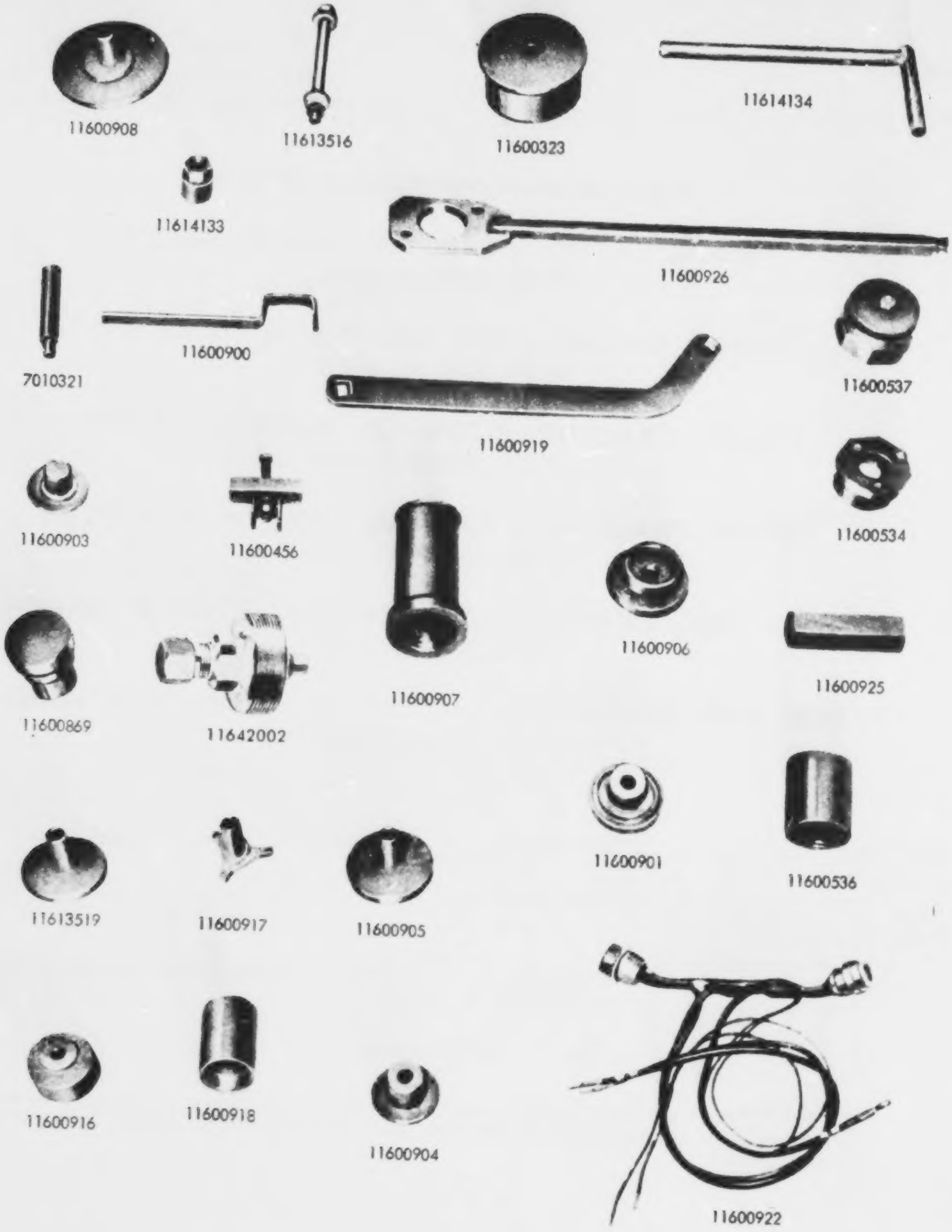

11600908
11613516
11600323
11614134
11614133
11600926
7010321
11600900
11600919
11600537
11600903
11600456
11600534
11600907
11600906
11600925
11600869
11642002
11600901
11600536
11613519
11600917
11600905
11600916
11600918
11600904
11600922
AT 37572

Figure 2-1. Special tools and equipment.

Page 2-5. Table 2-2 is changed as follows:

Table 2-2. Tools and Equipment—Continued

Item	(FSN) or part no.	Reference Fig. No.	Reference Para No.	Use
Bar:				
Knockout steering rod end	11614134	2-270	2-144	Remove power steering cylinder anchor stud and tie rod ends (use with 11614133 adapter).
Cable Assembly:				
Alternator test adapter	11600922	2-1	Table 2-5	Testing alternator (electrical) (use with TV-100 test set).
Puller Wheel:				
Steering	11600456	2-364	2-190	Remove steering wheel.
Remover:				
Torque rod ball stud	11600925	2-385	2-208	Remove torque rods.
Gage Assembly:				
Wheel bearing pre-load	11600534	2-299	2-148	Used with wrench, wheel bearing adjusting 11600537. Determine wheel bearing pre-load.
Wrench:				
Holding end yoke	11600926	2-261	2-142	Remove transfer assembly end yoke nut and differential thru shaft yoke nut.
Wrench, Socket:				
Wheel bearing adjusting	11600537	2-300	2-148	Torque gage assembly (use with 11600534 gage assembly).
Puller, Pulley:				
Air compressor	11642002	2-344	2-178	Remove air compressor belt pulley.

Page 2-9. Table 2-3. Items 14 and 15 are changed as follows:

Table 2-3. Preventive Maintenance Checks and Services

ORGANIZATIONAL SEMI-ANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
14	Air Compressor	Check compressor drive belt for wear or damage. Inspect compressor and air lines for damage and security. Operate engine and check operation of compressor. Be alert for unusual noises. Check air lines for leaks and operation of the warning buzzer and unloader governor.	Para 2-179
15	Generating System (Alternator and Wiring)	Check alternator drive belts for wear. Damage and proper tension (80-100 lbs) ($\frac{3}{8}$ inch deflection). Inspect alternator and wiring for damage and loose terminal connections. Operate engine and check alternator output.	Para 2-86, 2-87 and 2-88

Page 2-10. Table 2-3. Item 23 is changed and items 23.1 and 23.2 are added as follows:

Table 2-3. Preventive Maintenance Checks and Services

ORGANIZATIONAL SEMI-ANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
23	Air Reservoirs and Air Lines	Check air reservoirs (3) daily for accumulated moisture. With the vehicle air system at normal operating pressure, open drain cocks at bottom of tanks and allow to drain *only* until all moisture has drained and close cock. Check air lines, manifolds and fittings for damage and leaks.	Para 2-165
23.1	Pressurization Trap	Check the vehicle pressurization trap daily for accumulated moisture. With the vehicle air system at operating pressure and the pressurization system control lever at the "components" position, open the drain cock at the bottom of the trap. Leave drain cock open *only* until all moisture has drained and close cock.	Para 2-173
23.2	Air Separator	Check the vehicle air separator daily for accumulated moisture. With the vehicle air system at normal operating pressure, open drain cock at bottom of the separator. Leave cock open *only* until all moisture has drained and close cock.	Para 2-173

Page 2-12. Table 2-3. Item 36.1 is added as follows:

Table 2-3. Preventive Maintenance Checks and Services

ORGANIZATIONAL SEMI-ANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
36.1	Spring and Spring Wear Pads	Replace spring wear pads when inspection indicates the wear pads to be worn beyond the 3/16 inch minimum height limit or at replacement of spring assembly.	Para 2-205

Page 2-16. Table 2-4. Item 17 is superseded as follows:

INSTRUMENT PANEL GAGE TROUBLES

Malfunction	Probable cause	Corrective action
17. Air pressure gage does not indicate proper air pressure	*b.* Defective air trap.	*b.* Replace air trap assembly (para 2-173).

Page 2-22. Table 2-4. Items 61 and 62 are superseded as follows:

SERVICE BRAKES

Malfunction	Probable cause	Corrective action
61. Grabby brakes	*d.* Seized wheel bearings.	*d.* Replace wheel bearings, bearing cups, wheel bearing seals and seal wipers. (Ref. para 2-148).
62. Uneven braking	*e.* Loose or seized wheel bearings.	*e.* Replace seized wheel bearings, bearing cups, wheel bearing seals and seal wipers. (Ref. para 2-148).

Page 2-23. **Table 2-4. Items 68, 70, and 71 are superseded as follows:**

STEERING

Malfunction	Probable cause	Corrective action
68. Vehicle shimmy.	a. Loose or damaged wheel bearings.	a. Replace damaged wheel bearings, wheel bearing cups, wheel bearing seals and seal wipers. Adjust wheel bearing pre-load. (Ref. para 2-148).
	FRONT SUSPENSION	
70. Noise in one or more wheels.	a. Loose or damaged wheel bearings.	a. Adjust pre-load on loose bearings. Replace damaged wheel bearings, wheel bearing cups, wheel bearing seals and seal wipers. (ref. to para 2-148).
71. Noise in one or more axle ends.	c. Scored or seized wheel bearings.	c. Replace scored or seized wheel bearings, bearing cups, wheel bearing seals and seal wipers. (ref. to para 2-148).

Page 2-55. **Figure 2-22 is superseded as follows:**

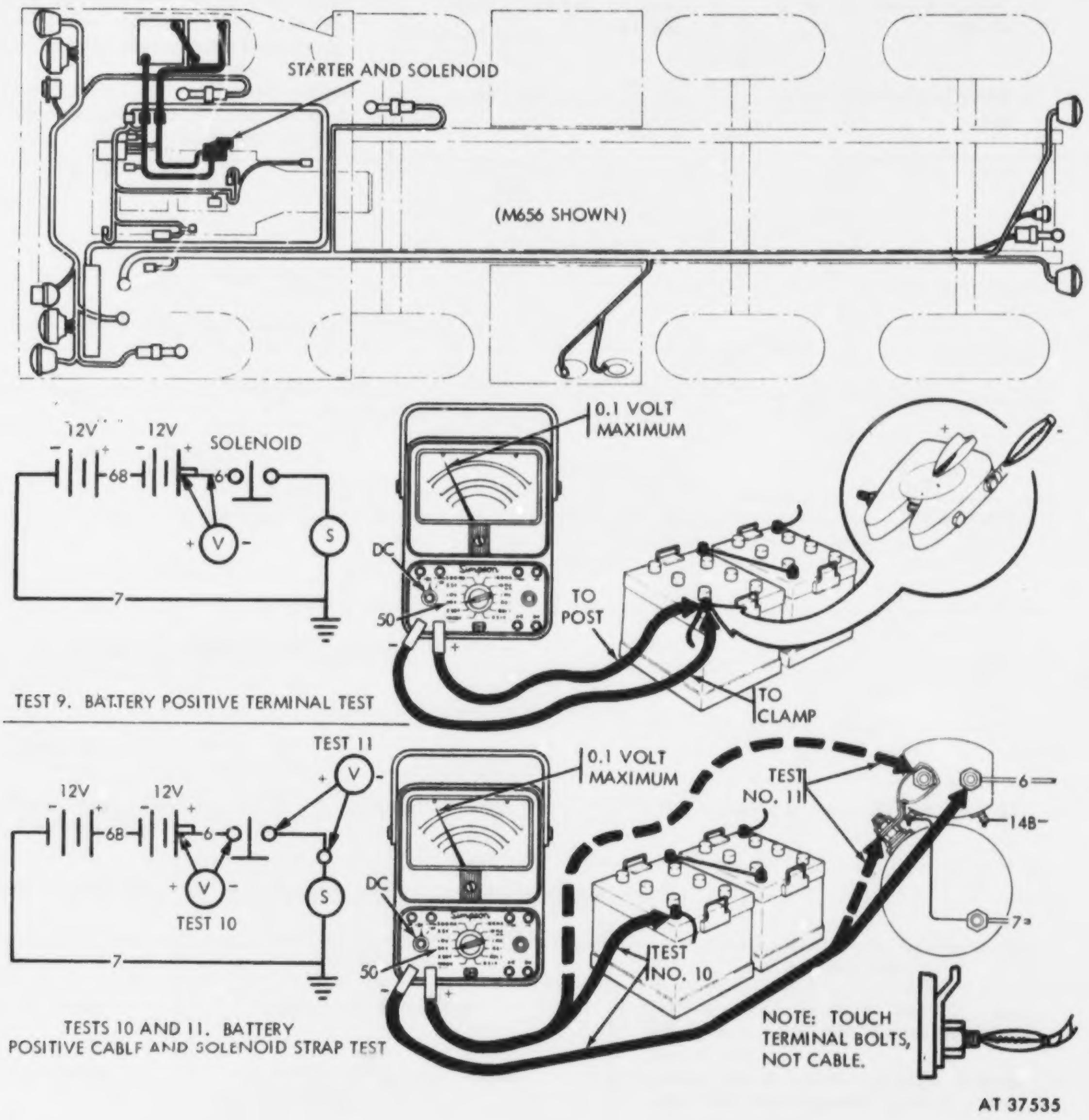
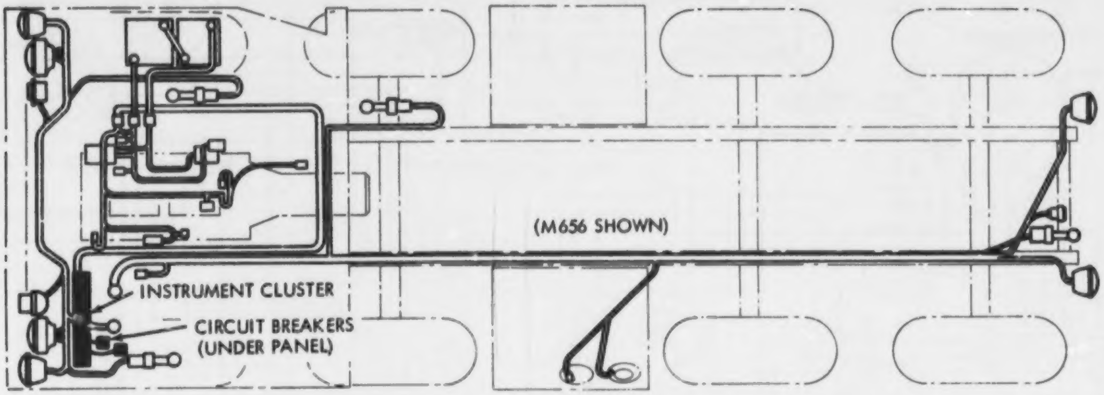
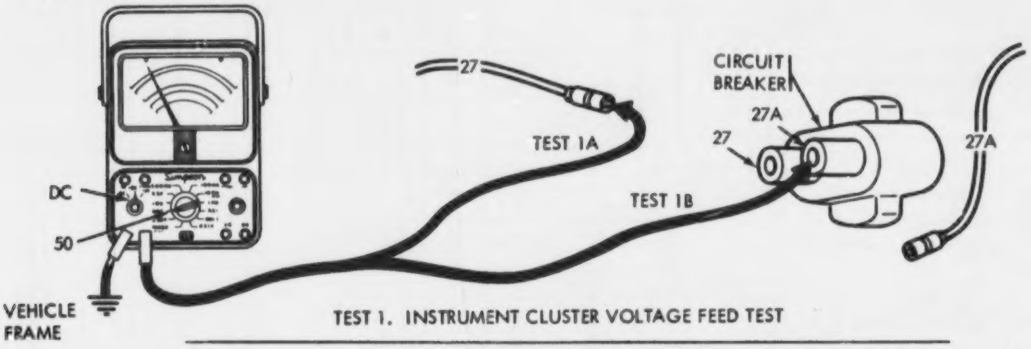

STARTER AND SOLENOID
(M656 SHOWN)
12V
12V
SOLENOID
68
6
V
S
7
TEST 9. BATTERY POSITIVE TERMINAL TEST
0.1 VOLT MAXIMUM
DC
50
TO POST
TO CLAMP
TEST 11
V
12V
12V
68
6
V
S
TEST 10
7
TESTS 10 AND 11. BATTERY POSITIVE CABLE AND SOLENOID STRAP TEST
0.1 VOLT MAXIMUM
DC
50
TEST NO. 11
6
14B
7
TEST NO. 10
NOTE: TOUCH TERMINAL BOLTS, NOT CABLE.
AT 37535

Figure 2-22. Starting system tests, third circuit (tests 9 through 11).

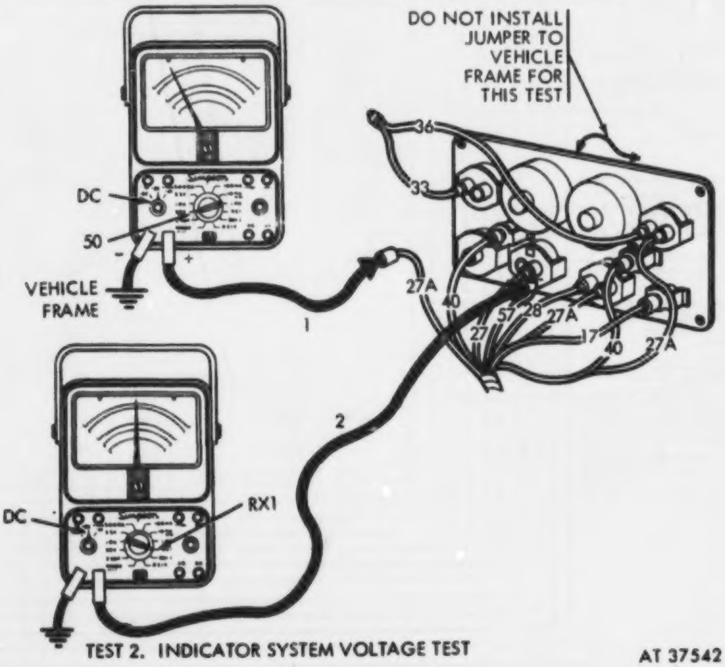
Page 2-87. **Figure 2-42 is superseded as follows:**


(M656 SHOWN)
INSTRUMENT CLUSTER
CIRCUIT BREAKERS
(UNDER PANEL)


27
TEST 1A
CIRCUIT
BREAKER
27A
27
27A
DC
50
TEST 1B
VEHICLE
FRAME

TEST 1. INSTRUMENT CLUSTER VOLTAGE FEED TEST

WIRE NO.	CIRCUIT
17	HIGH BEAM INDICATOR
27A	24 VOLTS FEED
27	24 VOLTS FEED
28	TO FUEL GAGE TRANSMITTER
33	TO TEMP. GAGE TRANSMITTER
36	TO OIL PRESS. GAGE TRANSMITTER
40	INSTRUMENT PANEL LIGHT
57	INSTRUMENT CLUSTER GROUND WIRE


DO NOT INSTALL
JUMPER TO
VEHICLE
FRAME FOR
THIS TEST
36
33
DC
50
-
+
VEHICLE
FRAME
27A
40
27
57
28
27A
17
40
27A
1
2
DC
RX1

TEST 2. INDICATOR SYSTEM VOLTAGE TEST

AT 37542

Figure 2-42. Instruments, gages and horn system (test 1 and 2).

Page 2-144. Figure 2-80 is superseded as follows:

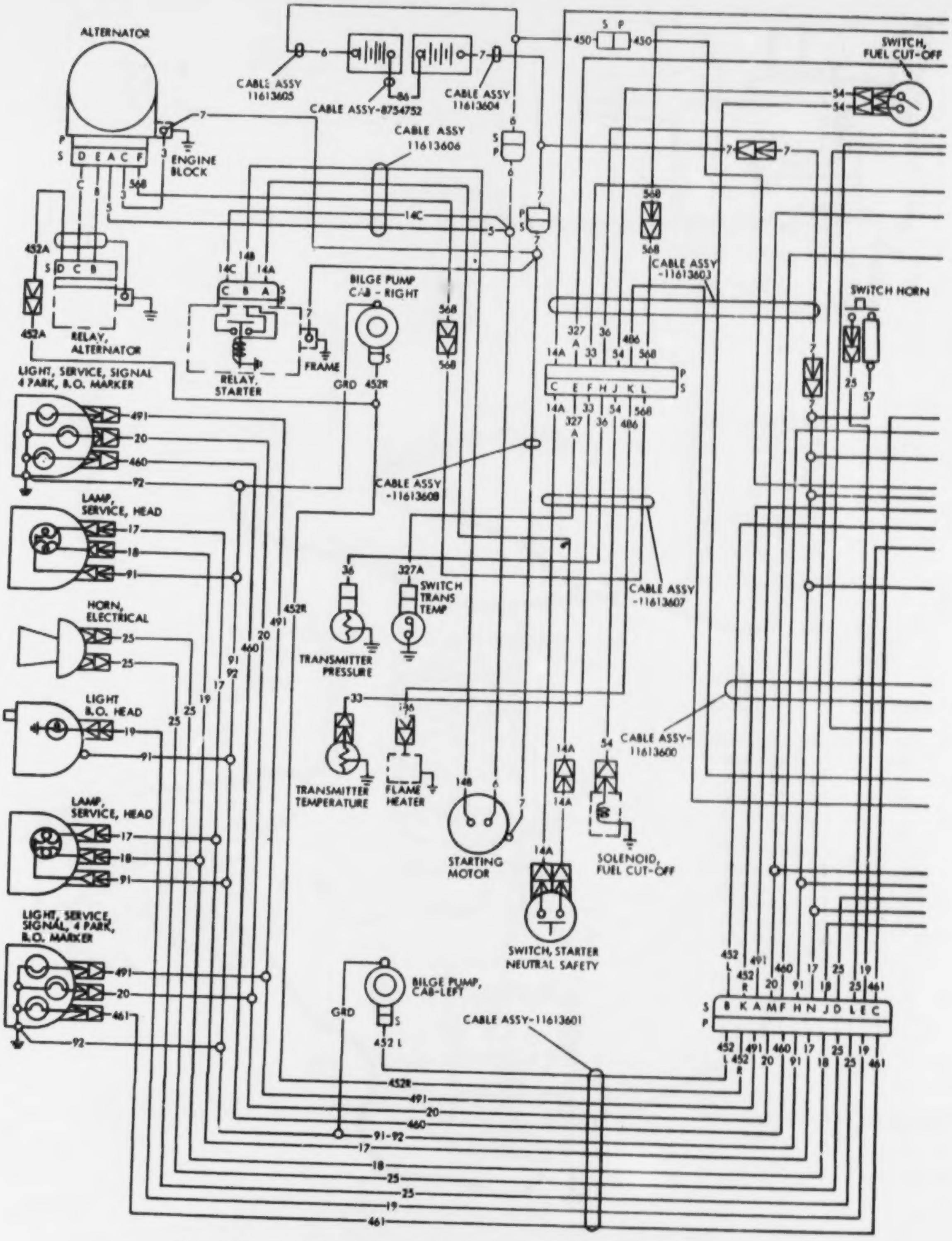

ALTERNATOR
ENGINE BLOCK
RELAY, ALTERNATOR
RELAY, STARTER
FRAME
CABLE ASSY 11613605
CABLE ASSY-8754752
CABLE ASSY 11613604
CABLE ASSY 11613606
CABLE ASSY -11613603
CABLE ASSY -11613608
CABLE ASSY -11613607
CABLE ASSY-11613600
CABLE ASSY-11613601
SWITCH, FUEL CUT-OFF
SWITCH HORN
BILGE PUMP CAB - RIGHT
GRD
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
LAMP, SERVICE, HEAD
HORN, ELECTRICAL
LIGHT B.O. HEAD
LAMP, SERVICE, HEAD
LIGHT, SERVICE, SIGNAL, 4 PARK, B.O. MARKER
SWITCH TRANS TEMP
TRANSMITTER PRESSURE
TRANSMITTER TEMPERATURE
FLAME HEATER
STARTING MOTOR
SWITCH, STARTER NEUTRAL SAFETY
SOLENOID, FUEL CUT-OFF
BILGE PUMP, CAB-LEFT
452R
491
20
460
91-92
17
18
25
25
19
461

Figure 2-80. Wiring diagram and circuit identification, M656 Truck.

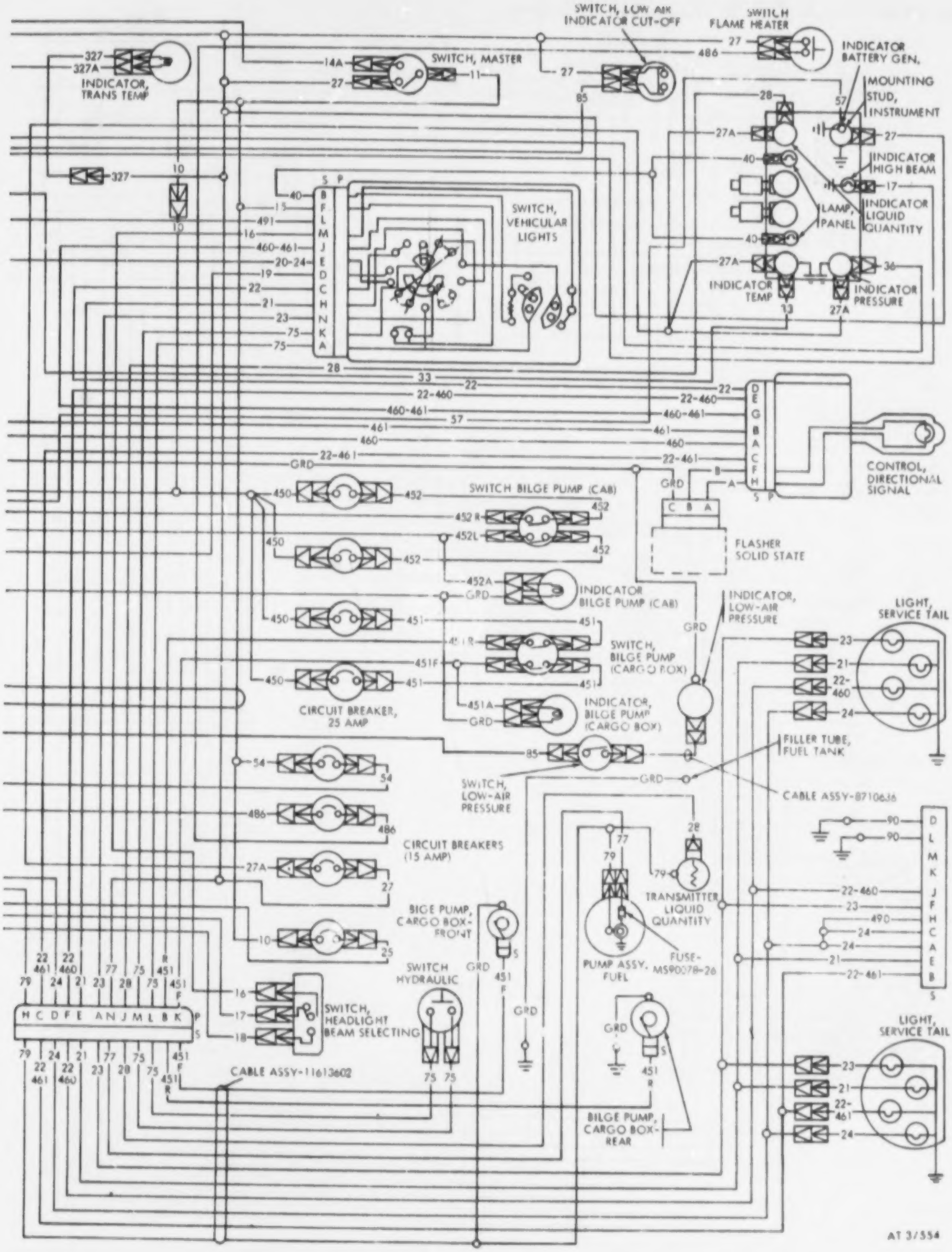

SWITCH, LOW AIR INDICATOR CUT-OFF
SWITCH FLAME HEATER
INDICATOR BATTERY GEN.
INDICATOR, TRANS TEMP
SWITCH, MASTER
MOUNTING STUD, INSTRUMENT
INDICATOR HIGH BEAM
INDICATOR LIQUID QUANTITY
LAMP, PANEL
INDICATOR TEMP
INDICATOR PRESSURE
SWITCH, VEHICULAR LIGHTS
CONTROL, DIRECTIONAL SIGNAL
FLASHER SOLID STATE
SWITCH BILGE PUMP (CAB)
INDICATOR BILGE PUMP (CAB)
INDICATOR, LOW-AIR PRESSURE
SWITCH, BILGE PUMP (CARGO BOX)
INDICATOR, BILGE PUMP (CARGO BOX)
CIRCUIT BREAKER, 25 AMP
SWITCH, LOW-AIR PRESSURE
FILLER TUBE, FUEL TANK
CABLE ASSY-8710636
LIGHT, SERVICE TAIL
CIRCUIT BREAKERS (15 AMP)
TRANSMITTER LIQUID QUANTITY
BIGE PUMP, CARGO BOX-FRONT
SWITCH HYDRAULIC
PUMP ASSY, FUEL
FUSE-MS90078-26
SWITCH, HEADLIGHT BEAM SELECTING
CABLE ASSY-11613602
BILGE PUMP, CARGO BOX-REAR
LIGHT, SERVICE TAIL
GRD
AT 3/554

Figure 2-80. Wiring diagram and circuit identification, M656 Truck. — Continued

***Page 2-146.* Figure 2-81. is superseded as follows:**

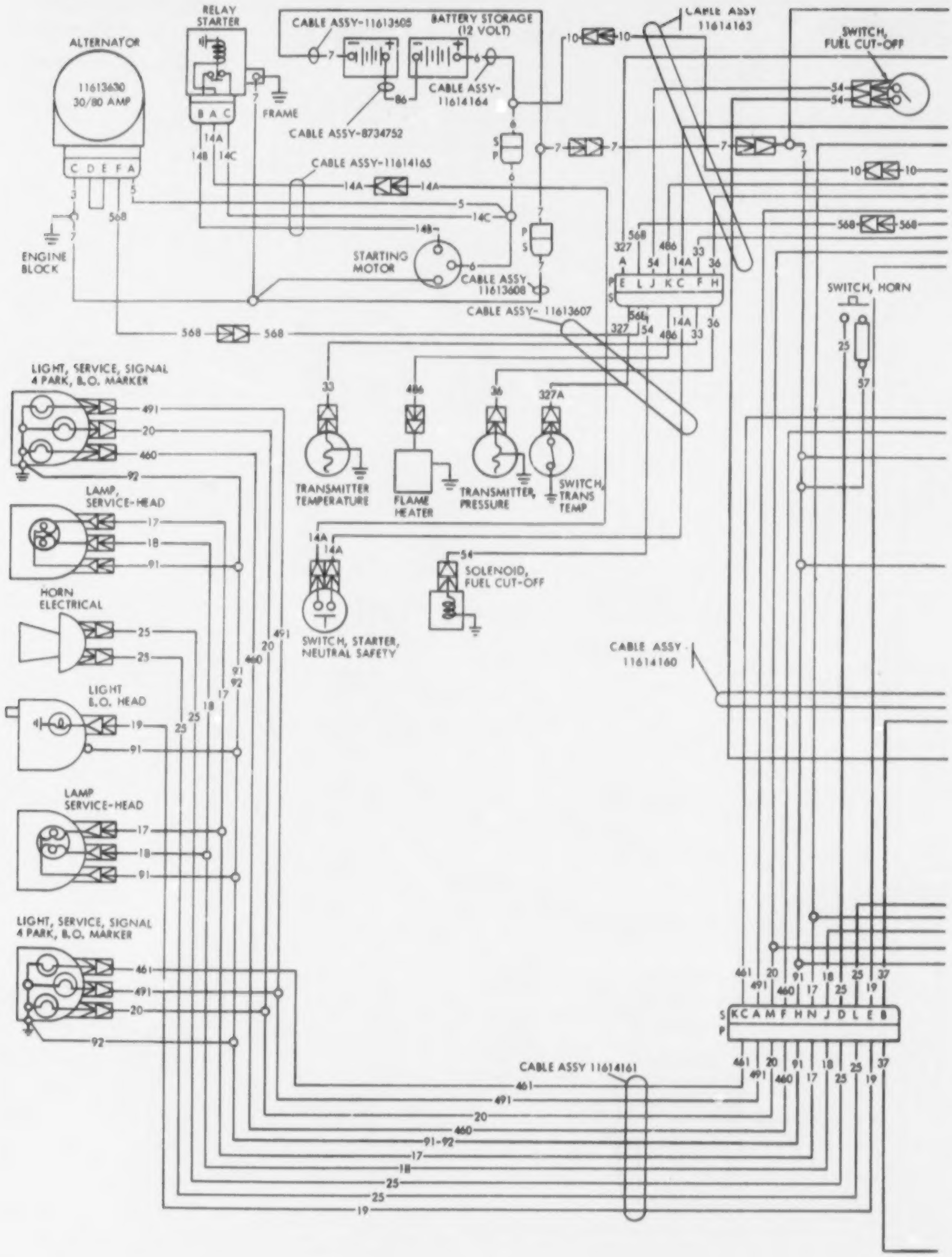

ALTERNATOR
11613630
30/80 AMP
C D E F A
ENGINE BLOCK
RELAY STARTER
B A C
FRAME
CABLE ASSY-11613605
BATTERY STORAGE (12 VOLT)
CABLE ASSY-11614164
CABLE ASSY-8734752
CABLE ASSY-11614165
STARTING MOTOR
CABLE ASSY 11613608
CABLE ASSY- 11613607
CABLE ASSY 11614163
SWITCH, FUEL CUT-OFF
SWITCH, HORN
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
LAMP, SERVICE-HEAD
HORN ELECTRICAL
LIGHT B.O. HEAD
LAMP SERVICE-HEAD
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
TRANSMITTER TEMPERATURE
FLAME HEATER
TRANSMITTER, PRESSURE
SWITCH, TRANS TEMP
SWITCH, STARTER, NEUTRAL SAFETY
SOLENOID, FUEL CUT-OFF
CABLE ASSY - 11614160
CABLE ASSY 11614161
E L J K C F H
K C A M F H N J D L E B
568
327
486
33
36
54
14A
14B
14C
327A
491
20
460
92
17
18
91
25
19
461
37
57
91-92
10
7
6
5
3

Figure 2-81. Wiring diagram and circuit identification. XM757 Truck.

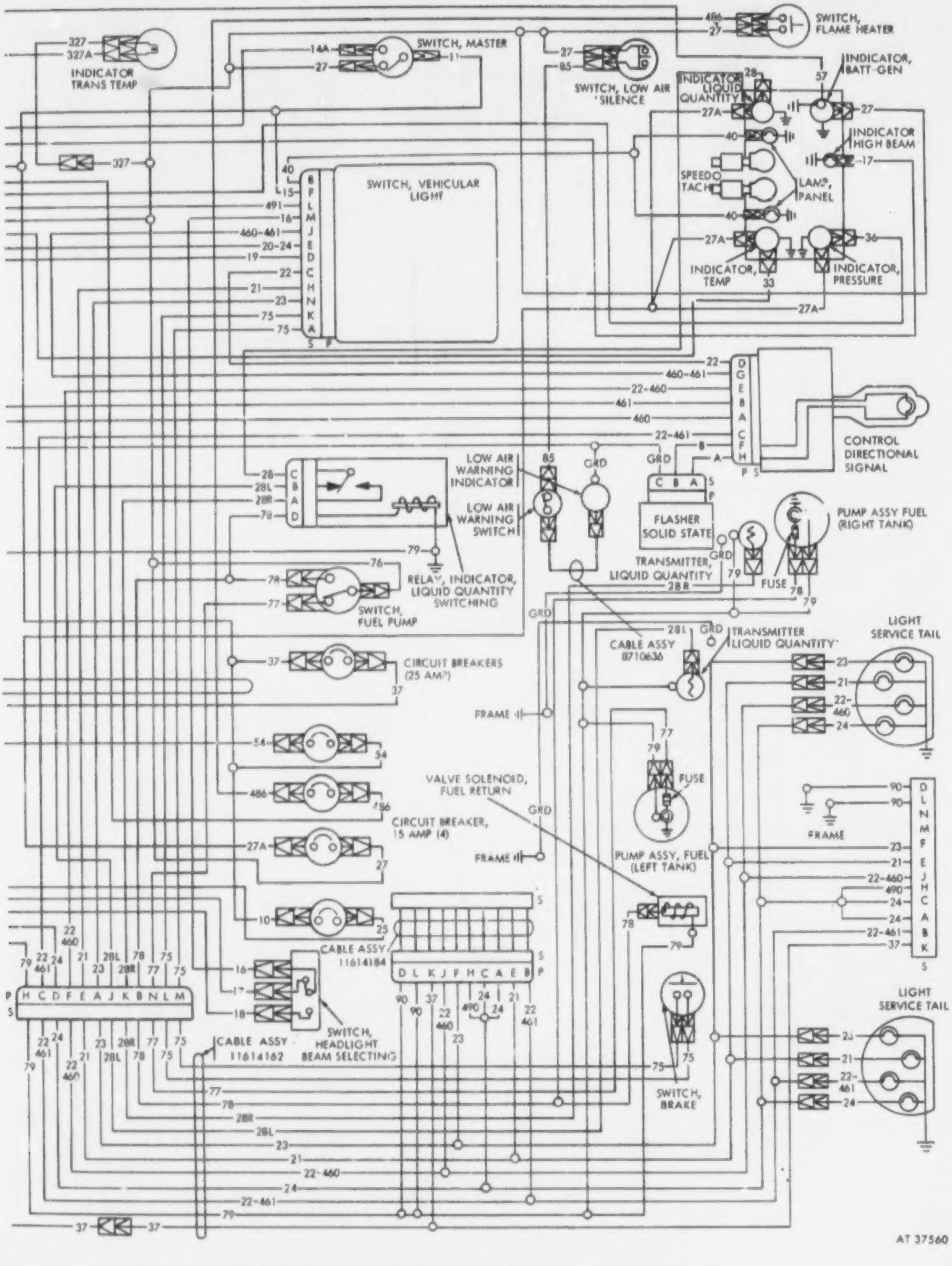

SWITCH, FLAME HEATER
SWITCH, MASTER
INDICATOR TRANS TEMP
SWITCH, LOW AIR SILENCE
INDICATOR, BATT-GEN
INDICATOR LIQUID QUANTITY
INDICATOR HIGH BEAM
SPEEDO
TACH
LAMP, PANEL
SWITCH, VEHICULAR LIGHT
INDICATOR, TEMP
INDICATOR, PRESSURE
CONTROL DIRECTIONAL SIGNAL
LOW AIR WARNING INDICATOR
LOW AIR WARNING SWITCH
FLASHER SOLID STATE
PUMP ASSY FUEL (RIGHT TANK)
TRANSMITTER, LIQUID QUANTITY
RELAY, INDICATOR, LIQUID QUANTITY SWITCHING
SWITCH, FUEL PUMP
FUSE
CABLE ASSY 8710636
TRANSMITTER LIQUID QUANTITY
LIGHT SERVICE TAIL
CIRCUIT BREAKERS (25 AMP)
FRAME
VALVE SOLENOID, FUEL RETURN
CIRCUIT BREAKER, 15 AMP (4)
PUMP ASSY, FUEL (LEFT TANK)
GRD
CABLE ASSY 11614184
CABLE ASSY 11614162
SWITCH, HEADLIGHT BEAM SELECTING
SWITCH, BRAKE
LIGHT SERVICE TAIL
AT 37560

Figure 2-81. Wiring diagram and circuit identification. XM757 Truck. — Continued

Page 2-148. Figure 2-82 is superseded as follows:

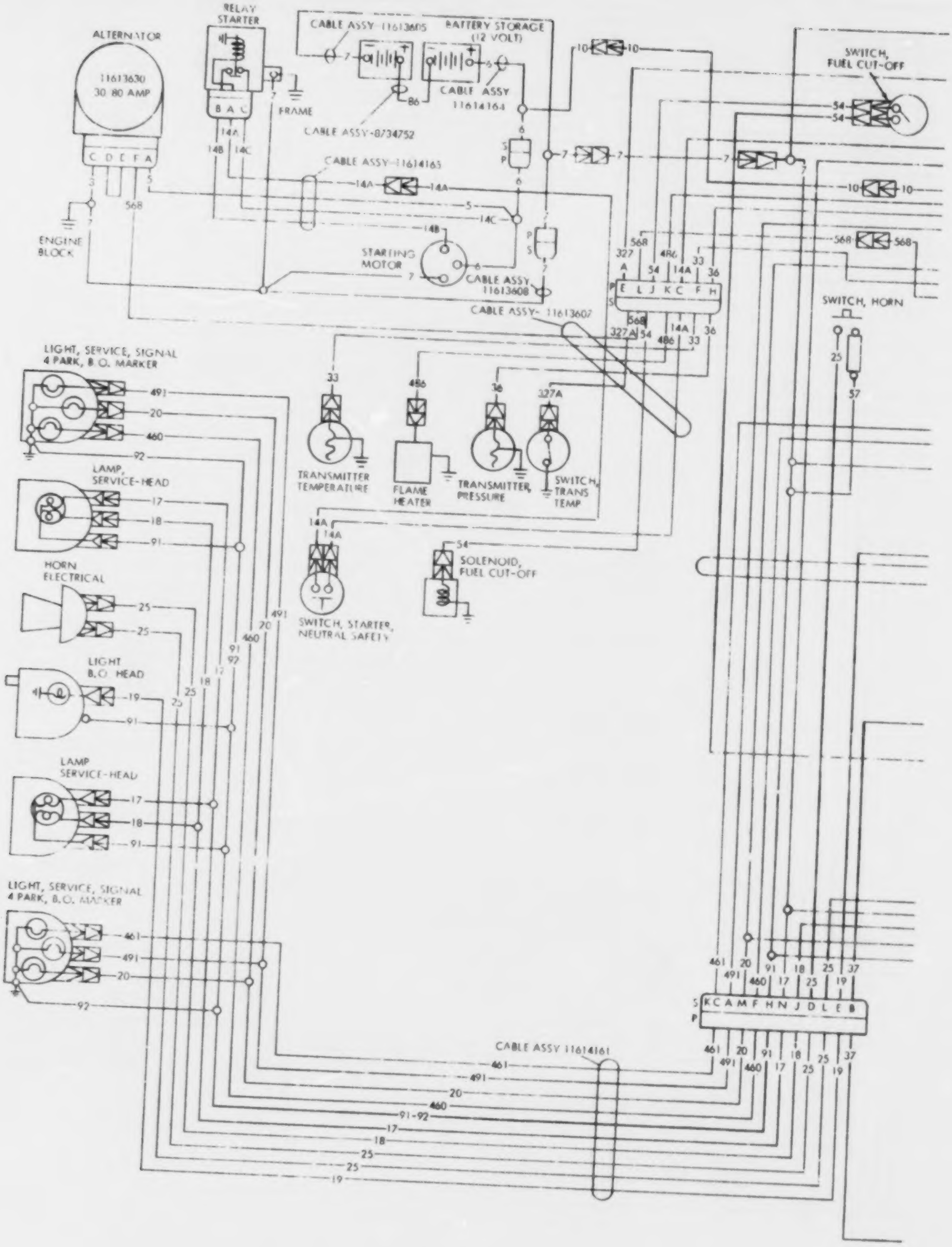

ALTERNATOR
11613630
30 80 AMP
C D E F A
ENGINE BLOCK
RELAY STARTER
B A C
FRAME
CABLE ASSY 11613605
BATTERY STORAGE (12 VOLT)
CABLE ASSY 11614164
CABLE ASSY-8734752
CABLE ASSY 11614165
STARTING MOTOR
CABLE ASSY 11613608
CABLE ASSY 11613607
SWITCH, FUEL CUT-OFF
SWITCH, HORN
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
LAMP, SERVICE-HEAD
HORN ELECTRICAL
LIGHT B.O. HEAD
LAMP SERVICE-HEAD
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
TRANSMITTER TEMPERATURE
FLAME HEATER
TRANSMITTER, PRESSURE
SWITCH, TRANS TEMP
SWITCH, STARTER, NEUTRAL SAFETY
SOLENOID, FUEL CUT-OFF
CABLE ASSY 11614161
K C A M F H N J D L E B

Figure 2-82. Wiring diagram and circuit identification. XM797 Truck.

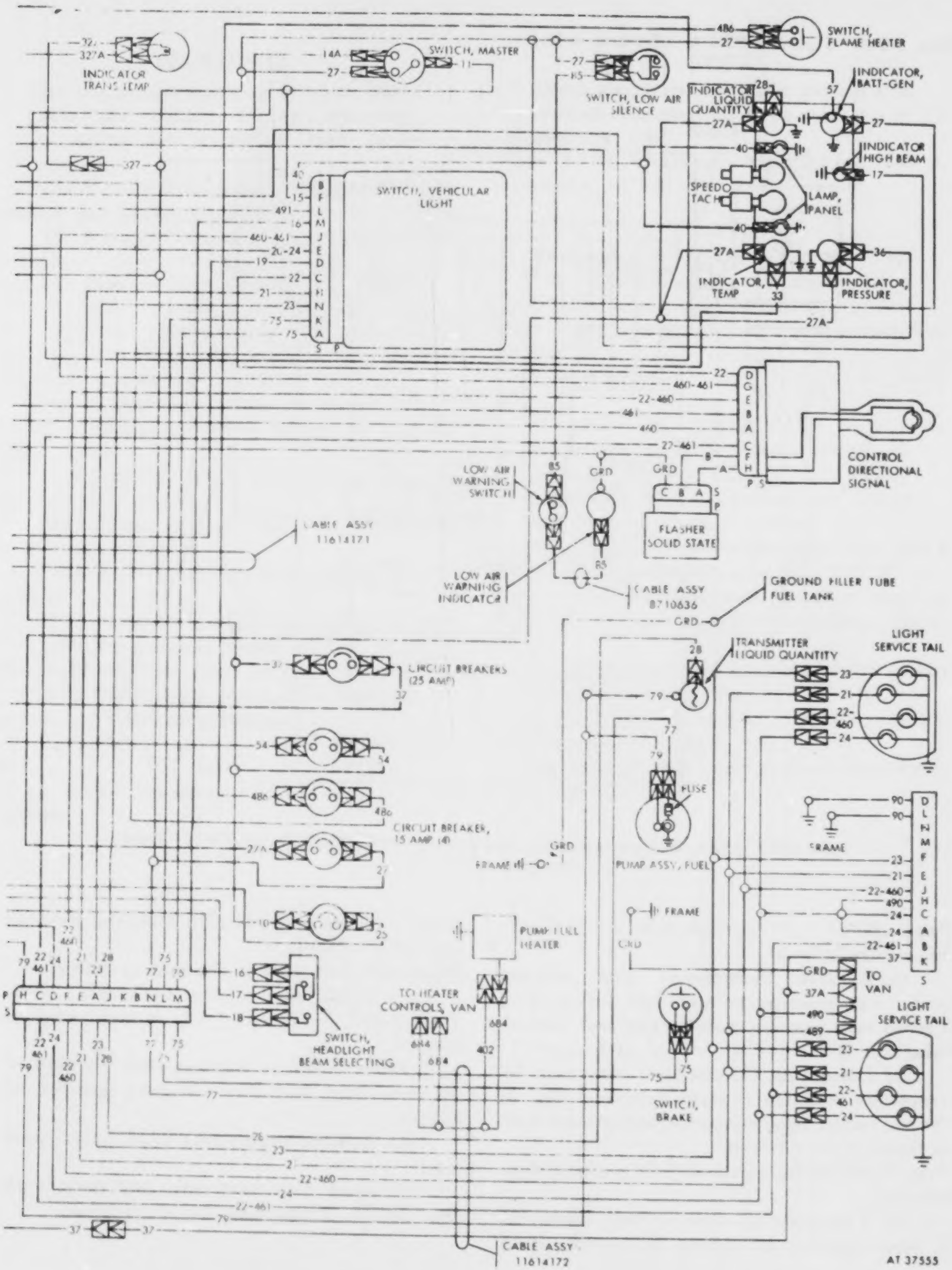

SWITCH, FLAME HEATER
INDICATOR TRANS TEMP
SWITCH, MASTER
SWITCH, LOW AIR SILENCE
INDICATOR, BATT-GEN
INDICATOR LIQUID QUANTITY
INDICATOR HIGH BEAM
SPEEDO TACH
LAMP, PANEL
SWITCH, VEHICULAR LIGHT
INDICATOR, TEMP
INDICATOR, PRESSURE
CONTROL DIRECTIONAL SIGNAL
FLASHER SOLID STATE
LOW AIR WARNING SWITCH
LOW AIR WARNING INDICATOR
CABLE ASSY 11614171
CABLE ASSY 8710636
GROUND FILLER TUBE FUEL TANK
TRANSMITTER LIQUID QUANTITY
LIGHT SERVICE TAIL
CIRCUIT BREAKERS (25 AMP)
CIRCUIT BREAKER, 15 AMP (4)
FRAME
GRD
FUSE
PUMP ASSY, FUEL
PUMP FUEL HEATER
TO VAN
TO HEATER CONTROLS, VAN
SWITCH, HEADLIGHT BEAM SELECTING
SWITCH, BRAKE
LIGHT SERVICE TAIL
CABLE ASSY 11614172
AT 37555

Figure 2-82. Wiring diagram and circuit identification, XM797 Truck. — Continued

Page 2-149. Figure 2-82.1 is added as follows:

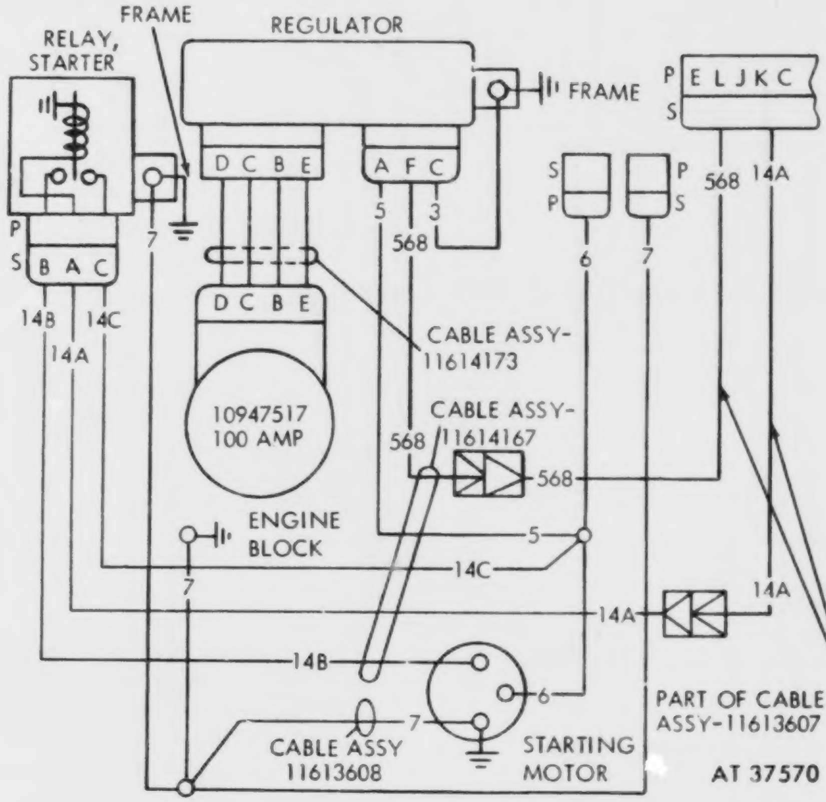

FRAME
RELAY, STARTER
REGULATOR
FRAME
P
E L J K C
S
D C B E
A F C
5
3
568
S
P
P
S
568
14A
7
6
7
P
S
B A C
14B
14C
14A
D C B E
CABLE ASSY-11614173
10947517
100 AMP
CABLE ASSY-11614167
568
568
ENGINE BLOCK
5
14C
7
14A
14A
14B
6
7
PART OF CABLE ASSY-11613607
CABLE ASSY 11613608
STARTING MOTOR
AT 37570

Figure 2-82.1. Wiring diagram and circuit identification M656, XM757, and XM791 Trucks (100 ampere alternator).

Page 2-153. Paragraph 2-37*a* (8)*(b)* is changed as follows:

(b) Remove transmission gear selector knob, shift position pointer and lockwasher. Discard shift position pointer and lockwasher.

Paragraph 2-37*b* (1) is changed as follows:

(1) Disconnect (3) electrical connectors at receptacles mounted to right bulkhead (fig. 2-93) and starter relay connector and ground lead on frame right side rail.

Page 2-166. Paragraph 2-40*f*(2) is changed as follows:

(2) Turn steering wheel in both directions to bleed steering oil system. Replenish oil in steering system reservoir after bleeding. Refer to LO 9-2320-230-12.

Paragraph 2-40*g*(3) is changed as follows:

(3) Install gear selector knob (fig. 2-92).

Page 2-177. Paragraph 2-52*c* is superseded as follows:

c. Filter Element Replacement. To replace the secondary fuel filter element, proceed as follows:

(1) Remove engine rear hatch cover (para 2-36).

(2) Open filter vent valve and drain cock (fig. 2-139). Drain fuel into a container.

WARNING

Do not permit smoking or open flame near the vehicle during removing, servicing or installing fuel filter elements.

(3) Loosen through bolt nut. Remove nut, washer and gasket securing cover (fig. 2-140).

(4) Remove housing cover and gasket (fig. 2-141).

(5) Remove filter element (fig. 2-141).

(6) Remove lower gasket from center post.

(7) Clean filter housing with solvent and blow parts dry with low pressure. Dry air and wipe with clean, lint free cloth.

(8) Position new gasket on center post.

(9) Position new filter element in housing (fig. 2-141).

(10) Position cover and new gasket on housing (fig. 2-141).

(11) Install through bolt nut, using new gasket (fig. 2-140).

(12) Tighten through bolt nut (85-95 lb-inch).

(13) Close filter drain cock (fig. 2-139).

(14) Turn master switch to "ON" position and bleed air from filter housing.

(15) Close drain valve and turn master switch to "OFF" position.

(16) Install engine rear hatch cover (fig. 2-92).

Page 2-180. Paragraph 2-57 *c* Add note as follows:

NOTE

Check torque on accelerator control arm to shaft retaining nut to be sure arm is secure to shaft.

Page 2-183. Paragraph 2-57 *g* (4) *(a)*. Note is superseded as follows:

NOTE

The engine idle speed should be (650-700 RPM), when the transmission selector lever is in the neutral position.

Page 2-190. Paragraph 2-70 *b* is superseded as follows:

b. Installation.

NOTE

On installation of the exhaust system, all sections of pipe should be loosely assembled until all gaskets are seated and pipes are properly alined.

(1) Position front exhaust pipe and install clamp at turbocharger outlet (fig. 2-165).

(2) Position crankcase breather hose on front exhaust pipe tube and install clamp (fig. 2-165).

(3) Using new gasket position clamp at rear of front exhaust pipe (fig. 2-164).

(4) Tighten all clamps, maintaining proper pipe alinement. (Torque 18-20 lb ft).

(5) Install engine rear hatch cover (refer to paragraph 2-36).

Page 2-191. Figure 2-164 is superseded as follows:

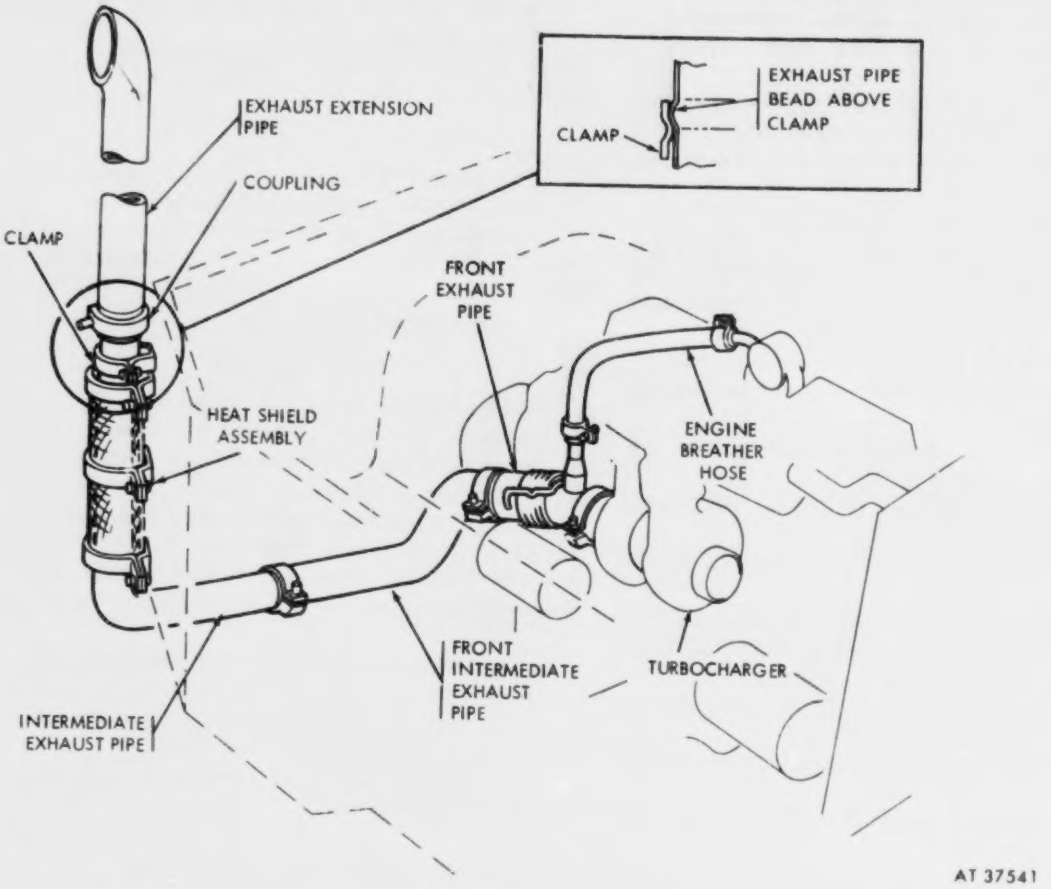

EXHAUST EXTENSION PIPE
COUPLING
CLAMP
EXHAUST PIPE BEAD ABOVE CLAMP
CLAMP
FRONT EXHAUST PIPE
HEAT SHIELD ASSEMBLY
ENGINE BREATHER HOSE
FRONT INTERMEDIATE EXHAUST PIPE
TURBOCHARGER
INTERMEDIATE EXHAUST PIPE
AT 37541

Figure 2-164. Engine exhaust system diagram.

Page 2-191. Paragraph 2-71 *b* is added as follows:

b. Installation.

NOTE

On installation of the exhaust system, all sections of pipe should be loosely assembled until all gaskets are seated and pipes are properly alined.

(1) Using new gasket position front intermediate exhaust pipe and install clamp at front exhaust pipe (fig. 2-164).

(2) Using new gasket install clamp securing front intermediate exhaust pipe to intermediate exhaust pipe (fig. 2-166).

(3) Tighten all clamps maintaining proper pipe alinement. (Torque 18-20 lb ft).

(4) Install engine rear hatch cover. Refer to paragraph 2-36.

Paragraph 2-72 *a* is superseded as follows:

a. Removal.

(1) Remove three bolts and flat washers securing exhaust pipe heat shield strap to cab wall (fig. 2-168). Remove heat shield.

(2) Loosen coupling securing exhaust extension pipe to intermediate pipe (fig. 2-167). Remove extension pipe and discard gasket.

(3) Remove two bolts, lockwashers and nuts securing engine exhaust pipe clamp to clamp bracket (fig. 2-168).

(4) Loosen coupling securing intermediate exhaust pipe to front intermediate exhaust pipe. Remove intermediate pipe and discard gasket. (fig. 2-166).

Page 2-193. Paragraph 2-72 *b* is superseded as follows:

b. Installation.

NOTE

On installation of the exhaust system, all sections of pipe should be loosely assembled until all gaskets are seated and pipes are properly alined.

(1) Using new gasket position intermediate exhaust pipe and install clamp securing intermediate exhaust pipe to front intermediate exhaust pipe (fig. 2-166).

(2) Install engine exhaust pipe clamp to clamp bracket (fig. 2-168). (Do not tighten bolt).

(3) Using new gasket position exhaust pipe extension and install clamp (fig. 2-167).

Page 2-195. Figure 2-173 is superseded as follows:

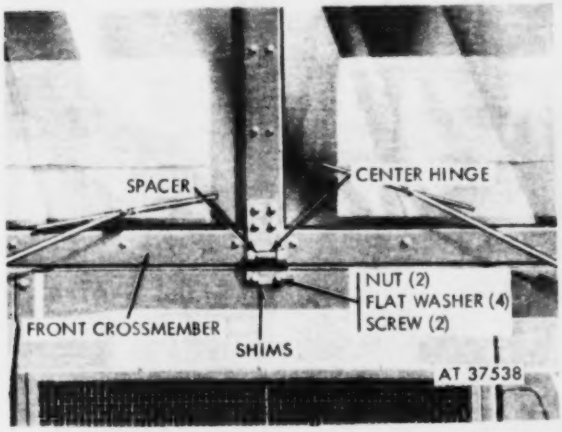


Figure 2-173. Windshield center hinge.

(4) Tighten all clamps, maintaining proper pipe alinement. (Torque 18-20 lb ft).

(5) Position bead of intermediate pipe above and in contact with pipe clamp (fig. 2-164) and tighten clamp bolt.

NOTE

Check to determine that clearance exists between underside of cab and intermediate exhaust pipe clamp.

(6) Install heat shield (fig. 2-168).

Page 2-197. Paragraph 2-75 *c* (6) is superseded as follows:

(6) *Fill system.* Close radiator and engine block drain cocks; then fill system to suit climatic conditions as follows: If above 32°F. partially fill the system with clean fresh water and add a corrosion inhibitor; then fill with water until coolant level is visible in filler neck. If there is a possibility that temperatures below 32°F. will be encountered, fill system as instructed in TB 750-651) with equal parts of water and antifreeze solution MIL-O-A-548. For expected temperatures below—40°F., fill radiator with antifreeze solution (FSN 6850-174-1806) undiluted. Install radiator cap, start engine and run at fast idle until temperature gage shows normal operating temperature; then stop engine and check coolant level, adding coolant as necessary.

Page 2-198. Paragraph 2-76 *b* (4) is superseded as follows:

(4) Raise hinge lower half upward and remove and retain shims and spacer (fig. 2-173) from under hinge.

Paragraph 2-76 *c* (2). Note is superseded as follows:

NOTE

When installing cab front crossmember, apply adhesive on both cab and seal surfaces prior to assembly. Also, position windshield hinge shims (fig. 2-173) as required between center hinge and cab crossmember to aline center hinge with outer, left and right windshield hinges.

Page 2-203. Paragraph 2-81 *d* (2) *(c)* is superseded as follows:

(c) Pry alternator away from engine until tension on each of the belts is such that thumb pressure applied midway between alternator and water pump pulleys causes a maximum of 3 / 8 inch deflection (80-100 pounds).

NOTE

The drive belts for the engine fan, and water pump and alternator must be checked for proper tension every 3000 miles or three months and prior to vehicle swimming operations. Specified belt tension must be maintained to insure against alternator and water pump belt slippage.

Page 2-204. Paragraph 2-84 *b.* Add the following:
(Ref. para 3-39) maintenance instructions for replacement of 100-ampere alternator.

Page 2-205. Paragraph 2-86 is superseded as follows:

a. Removal.

(1) Remove front and rear engine hatch cover, refer to paragraph 2-36.

(2) Loosen clamps securing air intake elbow to turbocharger inlet and air intake tube (fig. 2-155) (fig. 2-159) and remove elbow.

(3) Disconnect engine wiring ground cable and harness from alternator elbow connector (fig. 2-188 and fig. 2-189).

(4) Remove screw, lockwasher and flat washer securing adjusting bracket to alternator (fig. 2-188).

(5) Remove pressurization line at alternator (fig. 2-188).

(6) Attach lifting sling to alternator housing and mounting bracket.

(7) Loosen two nuts securing alternator to mounting bracket (fig. 2-189). Move alternator toward engine block and lift off three drive belts from alternator drive pulley (fig. 2-190).

(8) Remove three capscrews and lockwashers securing mounting bracket to engine and remove alternator with mounting bracket.

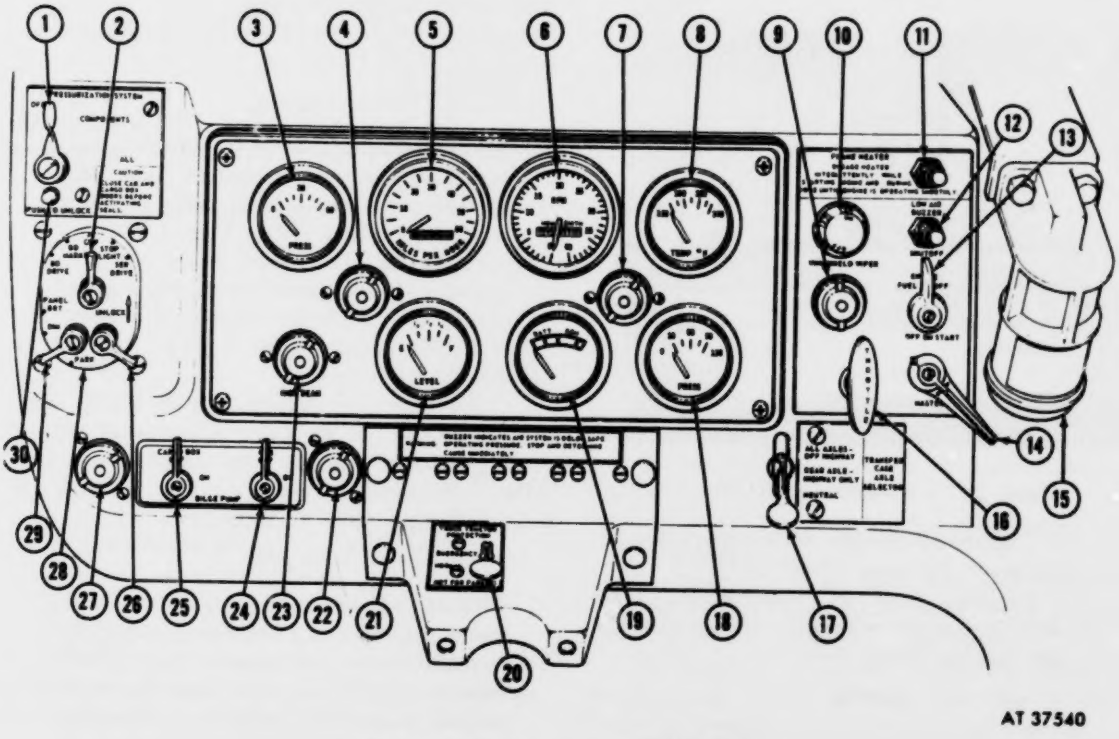
(9) Remove two nuts, lockwashers and bolts securing mounting bracket to alternator and remove mounting bracket.

(10) Remove nut, flat washer and woodruff key from alternator drive shaft and use puller to remove pulley from alternator.

Paragraph 2-86 *b.* Add subparagraph 9.1 as follows:

(9.1) Install turbocharger inlet elbow and two clamps and secure clamps at air intake tube and turbocharger inlet (torque 20-25 lb in). (fig. 2-155 and 2-159).

Page 2-209. Figure 2-197 is superseded as follows:



AT 37540

Figure 2-197. Instrument panel (typical).

Page 2-217. Figure 207 is superseded as follows:

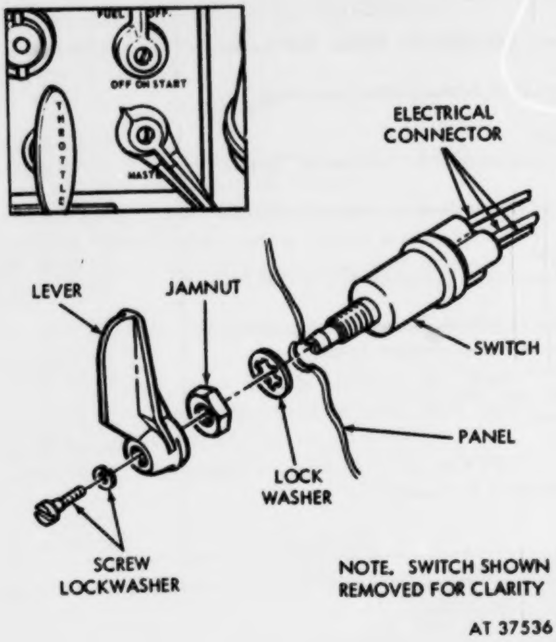


Figure 2-207. Instrument panel switches, removal and installation (typical).

Page 2-229. Paragraph 2-121 a. Note is added as follows:

NOTE

Tilt passenger seat forward to gain access to battery box. After removing battery box cover, flush top of batteries with clear water before removing caps to battery cells for servicing.

Page 2-235. Paragraph 2-124. Add the following:

Table (2-6) is provided for reference, to ensure proper torquing of the electrical connectors on vehicle wiring harness.

Table 2-6. Torque Values for Vehicles Wiring Harness Connectors

Cable No.	Nomenclature	Torque value
11613606 (M656) 11614165 (XM757-XM791)	Cable assembly, engine compartment disconnect (positive) to relays, alternator and starter.	90-95 lb. in.
	Positive to engine side wall	10-11 lb. ft.
	To alternator	90-98 lb. in.
	To starter relay	55-60 lb. in.
	To alternator relay (M656 only)	10-11 lb. ft.
11613607	Cable assembly, engine compartment disconnect to engine	80-85 lb. in.
11613608	Cable assembly, engine compartment disconnect (negative) to engine	34-40 lb. in.
11613604	Cable assembly (battery-positive)	
11613600 (M656) 11614171 (XM791) 11614160 (XM757)	Cable assembly—cab instrumentation	10-11 lb. ft.
	To cable 11613601	10-11 lb. ft.
	To cable 11613602	55-60 lb. in.
	To flasher	10-11 lb. ft.
	To lighting switch	70-75 lb. in.
	To turn signal control arm	55-60 lb. in.
	To fuel indicator relay (XM757)	30-40 lb. in.
11613601	Cable assembly, front lighting to bilge pump (M656)	30-40 lb. in.
11613602	Cable assembly, rear lighting to bilge pump (M656)	30-40 lb. in.
11613639	Cable assembly, cab disconnect to heater fuel pump (M656)	

Table 2-6. Torque Values for Vehicles Wiring Harness Connectors—Continued

Cable No.	Nomenclature	Torque value
11614189	Cable assembly, cab disconnect to heater fuel pump (XM757)	55-60 lb. in.
11600541	Cable assembly, personnel heater control to control box (XM757)	70-75 lb. in.
	To cable 11600545	90-95 lb. in.
11600545	Cable assembly, disconnect to personnel heater (XM757)	70-75 lb. in.
11600540	Cable assembly, personnel heater control (M656-XM791)	70-75 lb. in.
	To cable 11600544	90-95 lb. in.
11600544	Cable assembly, disconnect to personnel heater (M656-XM791)	70-75 lb. in.
11600543	Cable assembly, coolant heater control to control box	70-75 lb. in.
11600546	Cable assembly, disconnect to coolant heater	70-75 lb. in.
	To cable 11600543	90-95 lb. in.
11614167	Cable assembly 100 amp alternator	
	To engine side wall	90-95 lb. in.
	To regulator	10-11 lb. ft.
	To starter relay	90-98 lb. in.
11614173	Cable assembly, alternator to regulator	
	To alternator	10-11 lb. ft.
	To regulator	10-11 lb. ft.

Page 2-237. Paragraph 2-129 *a* is superseded as follows:

(1) Remove transmission drain plug and gasket and drain oil in suitable container. If copper plug gasket is damaged or deteriorated, replace gasket.

(2) After oil has drained, replace gasket and plug. Tighten plug.

(3) Remove screw, lockwasher and nut securing alternator cable clamp to transmission oil cooler lines and remove clamp (100 ampere alternator only) (para 3-39, page 3-31).

(4) Disconnect transmission oil outlet and inlet lines from right side of transmission housing (fig. 2-242).

(5) Disconnect transmission outlet and inlet lines from transmission thermostat housing (fig. 2-240).

(6) Remove screw, lockwasher and nut securing transmission outlet and inlet oil line clamps. Remove oil lines.

Page 2-251. Paragraph 2-145 *c* (2) is superseded as follows:

(2) Pack both axle shaft C-V joint and steering knuckle cavity with approximately one pound each with GAA type lubricant. Apply a light coating of GAA grease on axle shaft splines.

Paragraph 2-145 *c* (4). Add to note as follows: Use care when inserting spline end of C-V joint assembly through inner axle shaft oil seal.

Page 2-254. Paragraph 2-147 *c* is superseded as follows:

c. Installation.

(1) Thoroughly clean end of axle housing, axle shaft and C-V joint assembly and steering knuckle with suitable cleaning compound. Wipe dry with clean lint free cloth.

(2) Pack both axle shaft C-V joint and steering knuckle cavity with approximately one pound each GAA type lubricant. Apply a light coating of GAA type grease on axle shaft splines.

(3) Replace axle shaft oil seals (para 2-148 *d*).

(4) Apply sealer (MIL-S-7126—Type II) toboot clamp groove on both axle housing for inner boot clamp and steering knuckle housing for outer boot clamp.

(5) Place new boot, outer and inner boot clamps in position on axle housing, do not tighten clamp screw and nut.

NOTE

Position boot with "Top" marking in upper position and install inner clamp at bottom with head of screw facing toward front of vehicle.

(6) Position steering knuckle in place on end of axle housing over pins.

(7) After inner dust boot clamp is firmly

tightened, cut off protruding end of screw 3 / 16 inch from nut. File burrs from end of screw.

(8) Place boot and outer boot clamp in position on steering

NOTE

Install outer clamp screw with head facing toward front of vehicle.

(9) After outer dust boot clamp is firmly tightened, cut off protruding end of screw 3 / 16 inch from nut. File off burrs from end of clamp screw.

(10) Install steering knuckle bushings (para 2-146 *c*).

(11) Install axle shafts and C-V joint, sealed brake assembly, and wheel and tire assembly. (para 2-145 *c*).

Page 2-255. Paragraph 2-148 *b* (1). Delete TM reference.

Paragraph 2-148 *b* (8). add note as follows:

NOTE

It is mandatory that wheel bearing preload be checked prior to removal of the sealed brake and spindle assembly (para *d* above).

Paragraph 2-148 *b* (11) is superseded as follows:

(11) Remove four screws, four lockwashers, oil pan and remove outer wheel bearing face seal (fig. 2-285). Discard seal.

Paragraph 2-148 *b* (16) is superseded as follows:

(16) Tighten nut and press out bearing cup and face seal wiper (fig. 2-288). Discard wiper.

Paragraph 2-148 *b* (17) is superseded as follows:

Page 2-256. Figure 2-285 is superseded as follows:

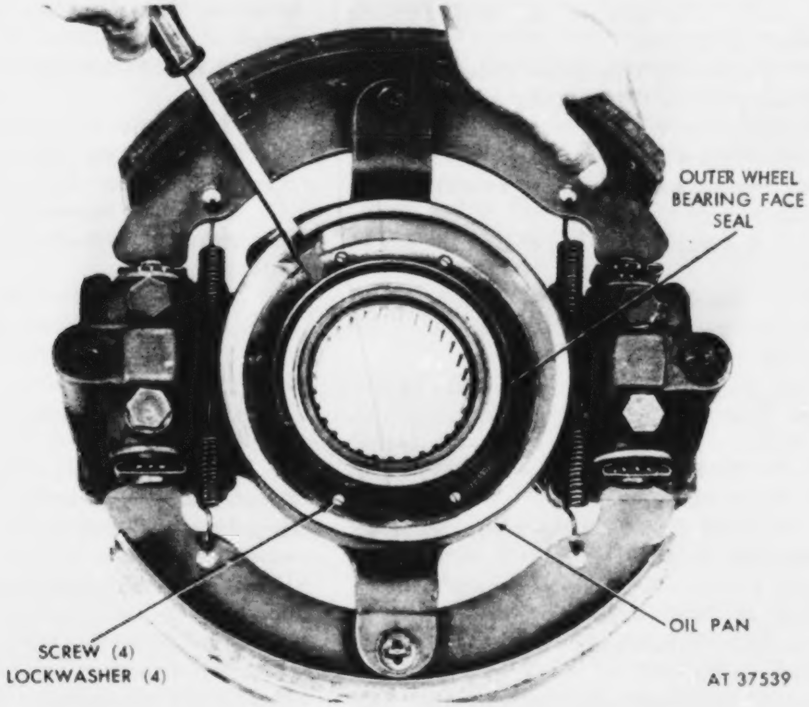


Figure 2-285. Sealed brake assembly.

(17) After bearing cup and face seal wiper are removed, turn hub assembly over and repeat operation to remove other bearing cup and face seal wiper. Discard wiper.

Paragraph 2-148 *b* (21) is superseded as follows:

(21) Remove hub triple lip seal wiper (fig. 2-289). Discard wiper.

Paragraph 2-148 *b* (22) is superseded as follows:

(22) Remove wheel bearing inner face seal (fig. 2-290). Discard seal.

Page 2-258. Paragraph 2-148 *d* (2) is superseded as follows:

(2) Always use new gaskets, seals, seal wipers and preformed packing. Apply sealer to gaskets, metal-encased oil seals and any screw threads that enter through tapped holes.

Page 2-260. Paragraph 2-148 *d* (12) is superseded as follows:

(12) Install 12 mounting nuts (fig. 2-289) and tighten to 48-61 lb-ft. Tighten nuts in sequence as shown in figure 2-294.

Page 2-261. Paragraph 2-148 *d* (17) is superseded as follows:

(17) Pack GAA type grease between lips of seal and use replacer (11600908) to install triple lip seal (fig. 2-297).

Paragraph 2-148 *d* (22) is superseded as follows:

(22) Install wheel bearing retaining ring (fig. 2-286).

Page 2-261. Paragraph 2-148 *d* (23.1) is added as follows:

(23.1) Install oil pan to sealed brake assembly and secure with four lockwashers and four screws (fig. 2-285).

Paragraph 2-148 *d* (24) is superseded as follows:

(24) Coat splines of wheel spindle with sealer (MIL-S-45180, Type II) and slide sealed brake with brake shoes on splines of wheel spindle (fig. 2-284).

Paragraph 2-148 *d* (35). Change torque value on mounting nuts to 48-61 lb-ft.

Paragraph 2-148 *d* (37). Change torque value on cap screws to 48-61 lb-ft.

Page 2-262. Paragraph 2-148 *d* (41) is superseded as follows:

(41) Install wheel and tire assembly and torque retaining nuts to 250-270 lbs. ft.

Page 2-264. Paragraph 2-153 *b* (1). Delete TM reference.

Paragraph 2-153 *c* (3). Change torque value to read: 48-61 lb-ft.

Paragraph 2-153 *c* (12) is added as follows:

(12) Install wheel and tire assembly and torque retaining nuts to 250-270 lbs. ft.

Page 2-270. Paragraph 2-161 *b* (1). Add note as follows:

NOTE

Apply sealant (MIL-S-12158, Type II) to seal area when reassembling hand brake cable (fig. 2-316).

Page 2-271. Paragraph 2-164 *a* is superseded as follows:

a. Service Brake System (figs. 2-318 through 2-321). The service brakes are controlled by a foot operated treadle valve on the floor of the cab. The XM757 vehicle also incorporates a hand control trailer brake valve mounted on the steering column. If a break occurs in an air line beyond the tractor-trailer protection valve, the air loss can be stopped by moving the tractor-trailer protection control valve to the emergency position. The nominal operating air pressure range of the air system is 105-125 psi.

Page 2-289. Paragraph 2-178 *b* is superseded as follows:

b. Installation.

(1) Install the compressor pulley belt on the crankshaft pulley sheave.

(2) Install compressor pulley belt on the compressor pulley adjustable sheave as far as possible.

(3) Install the compressor pulley, with the drive belt installed, onto the compressor shaft.

(4) Remove the two jack screws and the pulley flanges will close.

(5) Install self-locking nut on compressor crankshaft and tighten to 100 lb-ft (fig. 2-345).

(6) Install fan drive, water pump and alternator belts in reverse order of step one and two of removal. Adjust fan drive, alternator and water pump belts to 3/8 inch deflection (80-100 lb. belt tension) (para 2-81 *d* (1) and 2-86 *b* (6).

(7) Compressor pulley drive belt will adjust to proper tension when engine is run.

Page 2-291. Paragraph 2-184 *a* is superseded as follows:

a. Removal.

(1) Loosen eight nuts securing wheel and tire to hub.

(2) Raise axle to clear tire of ground.

CAUTION

Use wheel chocks to prevent vehicle from rolling when axle is raised to clear tire of ground.

(3) Remove eight nuts and remove wheel and tire assembly from vehicle.

(4) Remove cap, valve extension and valve core (fig. 2-352).

(5) Remove retaining ring and remove tire from wheel.

(6) Remove nut and valve from wheel.

Paragraph 2-184 *b* (2) delete (TM 9-1871) and substitute (TM 9-2610-200-20)

Page 2-292. Paragraph 2-184 *c* is superseded as follows:

c. Installation.

(1) Install nut and valve to wheel.

(2) Install valve core and valve extension (fig. 2-352).

(3) Apply soap solution to tire beads and wheel and install tire.

(4) Install retaining ring.

(5) Inflate tire to pressure designated on vehicle data plate and replace valve cap.

(6) Install wheel and tire on vehicle.

(7) Install eight nuts securing wheel and tire to hub.

(8) Lower vehicle to ground.

(9) Tighten wheel nuts to 250-270 lbs. ft.

Page 2-293. Paragraph 2-187.1 is added as follows:

287.1. Front Drag Link Removal

a. Removal.

(1) Start the engine and run at idle speed to obtain power assistance in turning wheels.

(2) Position wheels at full right turn angle. Stop engine.

(3) Remove and discard cotter pins and nuts securing drag link to pitman arm and power steering control valve (fig. 2-355 and fig. 2-365).

(4) Using knockout adapter (11614133) and knockout bar (11614134) loosen rod end (fig. 2-355).

(5) Fabricate spacer using (MS90725-162) bolt and (MS51967-20) nut and position with nut finger tight on bolt between the steering gear output shaft and steering gear lower mounting support bolt (11614004-3) (fig. 2-366.1).

(6) Turn nut on the bolt spacer a maximum of ½ turn to make sure spacer is tight between the steering gear output shaft and mounting bracket bolt (fig. 2-366.1).

(7) Using knock out adapter (11614133) and knock out bar (11614134), loosen drag link rod end stud at pitman arm.

(8) Remove bolt spacer.

(9) Vehicles with winch requires the following additional steps.

(a) Remove 3 bolts with washers and nuts (fig. 2-366).

(b) Loosen remaining bolt and nut (do not remove).

(c) Rotate housing clockwise until drag link can be removed from pitman arm.

(10) Remove drag link and discard seal.

b. Installation.

(1) Place new seal on rod end stud.

(2) Install drag link at power steering control valve stud and pitman arm.

(3) Vehicles with winch requires this step.

(a) Reposition steering gear and install bolts, nuts and washers and secure (fig. 2-366).

(4) Install retaining nuts on drag link and tighten nuts to 165-325 lb. ft. and secure with cotter pins.

Page 2-293. Paragraph 2-187 *b* (1) is superseded as follows:

(1) Remove and discard cotter pin and nut from each end stud of rod to be removed.

Paragraph 2-187 *d* (3) is superseded as follows:

(3) Position opposite end of rod in its respective position and secure each rod end stud with new nut. Tighten nuts to 165-325 lb. ft. and install new cotter pins.

Paragraph 2-188 *a* (1) is superseded as follows:

(1) Remove and discard cotter pin and nut from each end stud of rod to be removed.

Paragraphs 2-188 *c* (2) and (3) are superseded as follows:

(2) Position tie rod assembly on steering knuckle arms and secure, using new nuts.

(3) Tighten nut on one rod end to 165-325 lb-ft and secure using new cotter pin.

Page 2-295. Paragraph 2-188 *c* (4) is superseded as follows:

(4) Check toe-in of wheels. Refer to paragraph 2-196 and make necessary adjustment before securing opposite rod end stud. When proper toe-in is achieved, tighten stud nut to 165-325 lb-ft and secure with new cotter pin.

Paragraph 2-189 *a* (1) is superseded as follows:

(1) Remove and discard cotter pin and nut from front reach rod, rear reach rod and drag link at idler arm mounting.

Paragraph 2-189 *a* (3) is superseded as follows:

(3) Remove cotter pin, nut and thrust washer securing idler arm to idler arm bracket. Discard cotter pin and nut.

Paragraph 2-189 *b* (1) is superseded as follows:

(1) Remove and discard seal from each end of idler arm.

Page 2-297. Paragraph 2-189 *e* (4) is superseded as follows:

(4) Install nuts on front reach rod, rear reach rod and drag link rod end studs. Tighten nuts to 165-325 lb-ft and secure each nut with cotter pin (fig. 2-360).

Page 2-299. Paragraph 2-191 *a* is superseded as follows:

a. Worm Pre-Load Adjustment (Gear in Vehicle).

(1) Start the engine and run at idle speed to obtain power assistance in turning wheels.

(2) Position wheels at full right turn angle. Stop engine.

(3) Remove and discard cotter pin and nut securing drag link to pitman arm.

(4) Fabricate spacer using (MS90725-162) bolt and (MS51967-20) nut and position with nut finger tight on bolt between the steering gear output shaft and steering gear lower mounting support bolt (11614004-3) (fig. 2-366.1)

(5) Turn nut on the bolt spacer a maximum of ½ turn to make sure spacer is tight between the steering gear output shaft and mounting bracket bolt (fig. 2-366.1).

(6) Install knockout adapter (11614133) on drag link ball stud.

(7) Using knockout bar (11614134) and a hammer, loosen drag link rod end stud in pitman arm.

(8) Remove knockout adapter.

(9) Remove bolt spacer.

(10) Vehicle with winch requires the following additional steps.

(a) Remove 3 bolts with washers and nuts (fig. 2-366).

(b) Loosen remaining bolt and nut (do not remove).

(c) Rotate housing clockwise until drag link can be removed from pitman arm.

(11) Remove drag link and discard seal.

(12) Turn steering wheel to full right or left, counting turns. Turn halfway back; this will center steering gear.

(13) Loosen thrust adjusting screw locknut (fig. 2-366). Turn screw as necessary until no backlash is present within 30° of each side of center position.

(14) Hold screw and tighten locknut to 16-20 lb. ft.

(15) Place new seal on rod end stud.

(16) Place drag link rod end stud on pitman arm.

(17) Vehicles with winch requires this step. Reposition steering gear and install bolts, nuts and washers and secure (fig. 2-366).

(18) Install retaining nut on drag link and tighten nuts to 165-325 lb. ft. and secure with new cotter pin.

Paragraph 2-192 *c* (4). Deleted

Page 2-299. Figure 2-366 is superseded as follows:

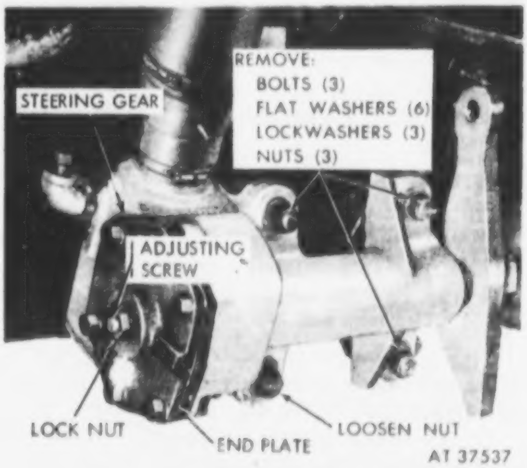


Figure 2-366. Steering gear housing assembly and adjusting screw.

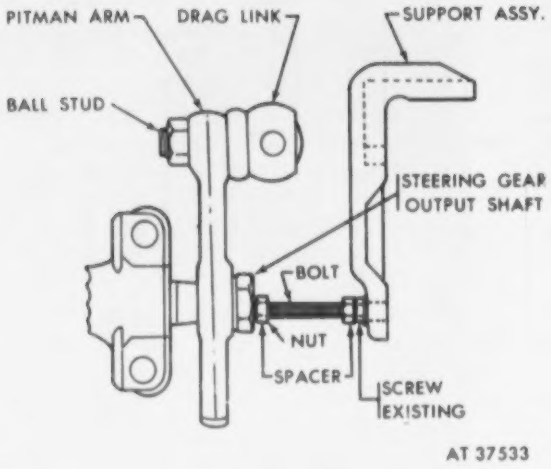


Figure 2-366.1. Removing drag link from pitman arm.

Page 2-300. Paragraph 2-193 a is superseded as follows:

NOTE

Key letters shown in parentheses refer to fig. 2-368.

a. Removal.

(1) Drain power steering fluid as directed in paragraph 2-192.

(2) Disconnect inlet hose (3) and outlet hose (2) from power cylinder and remove fittings.

(3) Remove and discard cotter pin and retaining nut at anchor ball stud (fig. 2-368(8)).

(4) Remove cylinder anchor ball stud assembly (8), using knockout adapter (11614133) and knockout bar (11614134) through hole in front bumper.

(5) Remove and discard seal.

(6) Remove front drag link (7) from power cylinder control ball stud (6) and rear link (4) from idler arm as directed in paragraph 2-189.

(7) Loosen clamp bolt(s) and unscrew rear drag link (4) from power cylinder. Remove power cylinder and control valve assembly.

(8) Remove anchor ball stud from cylinder operating rod.

Page 2-301. Paragraph 2-193 *b* is superseded as follows:

b. Installation.

(1) Install anchor ball stud on cylinder operating rod (fig. 2-369).

NOTE

The distance between the ball end assembly and in board end of flat surface of cylinder rod must be ½ inch (fig. 2-369).

(2) Install rear drag link (4), with new seal, to cylinder and valve assembly. Do not tighten clamp bolt (5).

(3) Install complete assembly on vehicle.

NOTE

The distance from center of ball stud on idler arm to end face of cylinder (where valve and cylinder join must be 33 5 / 16 inch with front wheels in straight ahead position). (fig. 2-372)

(4) Install rear drag link (4) at idler arm and front drag link (7) at power cylinder control ball stud (paragraph 2-187 *d*). Tighten clamp nut (5) on rear drag link (4).

(5) Install anchor ball stud on pitman arm.

(6) Install fittings and power steering hoses (2 and 3) on power steering valve assembly.

(7) Fill system with hydraulic fluid as directed in paragraph 2-192.

(8) Adjust steering linkage as directed in paragraph 2-196.

Page 2-305. Paragraph 2-196 *b* (1) is superseded as follows:

(1) Start engine and run at idle speed to obtain power assistance in turning wheels.

Paragraph 2-196 *c* is superseded as follows:

c. Steering stop adjustment. Refer to figures 2-372 and 2-373 and proceed as follows:

(1) Start the engine and run at idle speed to obtain power assistance in turning wheels.

CAUTION

Relieve bogie inter-axle offset by driving back and forth several times in a straight line, with steering wheel in a straight ahead position. This will align wheels on number 2 axle with wheels on number one axle. Vehicles weight must be on both front axles throughout the steering stop adjustment procedure.

(2) Turn the steering wheel to the left until a ⅛ inch thick gage becomes tight between the stop screw on stop pad on the axle housing (fig. 2-373).

(3) Release the steering wheel to remove tension from steering linkage.

(4) Loosen locknut on the pitman arm stop screw (fig. 2-372).

(5) Adjust stop screw to zero clearance between the stop screw and pitman arm.

(6) Tighten locknut on pitman arm stop screw.

(7) Turn steering wheel full right and repeat above operations for right steering stop adjustment.

(8) Both full right and left turns should be adjusted to give cleanrance at the axle housing screw stops and zero clearance at the pitman arm screw stops.

(9) Road test vehicle, checking particularly for vehicle steering appreciably shorter one way than the other.

NOTE

After road test relieve inter-axle offset and check for axle steering stop clearance on full right and left turns. Readjustment is necessary only if "no clearance" axle steering stop condition exists.

Page 2-310. Paragraph 2-205a(3). Note is superseded as follows:

NOTE

This removal procedure will apply to all spring wear pads. Spring wear pads must be inspected during the 12,000 mile service. When inspection indicates the wear pads to be worn beyond the 3 / 16 inch minimum height limit, pads must be replaced. They are also mandatory replacement when a vehicle spring pack is replaced.

Page 2-313. Paragraph 2-214 *a* (3). Deleted

Page 2-317. Paragraph 2-221 *b* is superseded as follows:

b. Assembly.

NOTE

On reassembly of windshield a check should be made for proper alinement of the center windshield hinge with left and right outer hinges. A shim pack is provided for this purpose. These shims when properly installed will prevent windshield frame distortion.

(1) Remove two screws, washers and nuts securing center windshield hinge to cab.

(2) Position shims (11600964-1) 1 / 16 inch thick or (11600964-2) 1 / 32 inch thick as required between center hinge and cab to aline center hinge with outer, left and right windshiled hinges.

(3) Reinstall two screws, washers and nuts securing center hinge with shims to cab.

Page 3-11. Paragraph 3-9*j*(2) is superseded as follows:

(2) *Installation.* Refer to removal procedure and reverse sequence except as follows:

(a) Rotate elbow fitting on bottom of air manifold approximately 30 degrees counterclockwise from straight back (fig. 3-12).

(b) Rotate elbow fitting on air governor approximately 10 degrees counterclockwise from vertical.

NOTE

After rotating the fittings of the two air lines, check clearance; make sure that lines are not touching or rubbing any item.

(c) Check fittings to be sure that there are no air leaks.

1. Manifold air line is under pressure only when vehicle pressurization system has been activated.

2. Governor air line is only under pressure when air system pressure has reached compressor cut out pressure and until it drops to cut in pressure. No leaks will be observed unless these conditions are met.

NOTE

Above procedure must be followed to prevent chafing between air lines and fittings.

Page 3-12. **Figure 3-12 is superseded as follows:**

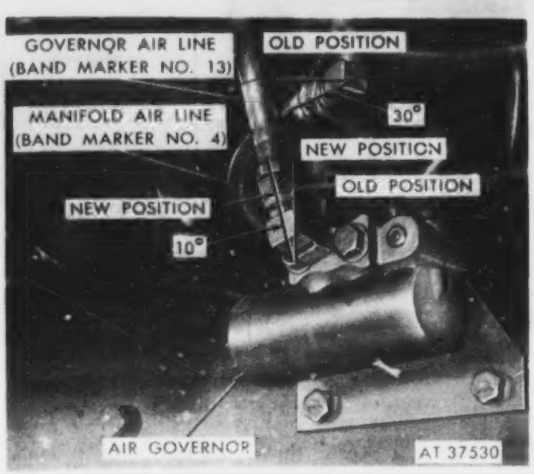

GOVERNOR AIR LINE (BAND MARKER NO. 13)
OLD POSITION
30°
MANIFOLD AIR LINE (BAND MARKER NO. 4)
NEW POSITION
OLD POSITION
NEW POSITION
10°
AIR GOVERNOR
AT 37530

Figure 3-12. Alcohol vaporizer connections to air governor and cab outside rear bulkhead.

Page 3-16. **Figure 3-16 is superseded as follows:**

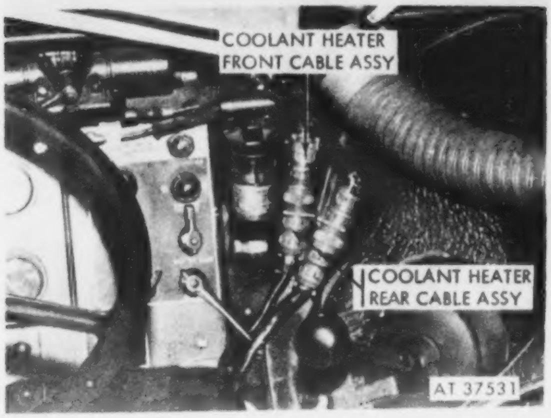

COOLANT HEATER FRONT CABLE ASSY
COOLANT HEATER REAR CABLE ASSY
AT 37531

Figure 3-16. Coolant heater front and rear cable assembly connection.

Page 3-28. **Paragraph 3-37 *a* is superseded as follows:**

_a_. A systematic inspection at regular intervals should be perfromed to assure that the 100-ampere alternator kit has no defects which might result in damage or in failure. For checking circuits, refer to paragraph 2-21 and figure 2-2 low voltage circuit tester (TV-100). Any defects which are not within the scope of the operator or organizational maintenance personnel should be reported to direct support maintenance.

Table 3-7. Item 1 is superseded as follows:

ORGANIZATIONAL SEMI-ANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
1	Belts	Check for fan and alternator belt tension. All belts should have approximately ⅜ inch deflection (80-100 lb)	Para 3-39*c*

Page 3-29. Table 3-8. Item 1 is superseded as follows:

Malfunction	Probable cause	Corrective action
1. No output	*a*. Broken or loose belts.	*a*. Adjust belts to ⅜ inch deflection (80-100 lb.) or replace (para 3-39)

Page 3-31. Paragraph 3-39*a*.(1)*(d)* is superseded as follows:

d. Remove nut and clamp holding cable to transmission oil cooler lines.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of St[illegible]

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-38, Organizational maintenance requirements for Truck, 5-Ton, 8X8, Cargo, M656; Tractor, XM757; Van, Expansible, XM791.

TECHNICAL MANUAL
No. 9-2320-230-20

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20025 *16 April 1969*

ORGANIZATIONAL MAINTENANCE MANUAL

TRUCK, CARGO: 5-TON, 8x8, M656
TRUCK, TRACTOR: 5-TON, 8x8, XM757
TRUCK, VAN, EXPANSIBLE: 5-TON, 8x8, XM791

CHAPTER 1. INTRODUCTION

		Paragraphs	Pages
Section I.	General	1-1, 1-2	1-1
II.	Description and data	1-3, 1-5	1-1, 1-7

CHAPTER 2. SERVICE AND MAINTENANCE INSTRUCTIONS

		Paragraphs	Pages
Section I.	Service upon receipt of materiel	2-1, 2-4	2-1, 2-2
II.	Movement to a new worksite	2-5, 2-6	2-2
III.	Repair parts, special tools and equipment	2-7, 2-8	2-3, 2-5
IV.	Lubrication	2-9, 2-10	2-5
V.	Preventive-maintenance checks and services	2-11, 2-17	2-5, 2-7
VI.	Troubleshooting vehicle	2-18, 2-19	2-12, 2-13
VII.	Troubleshooting the electrical system	2-20, 2-27	2-24, 2-129
VIII.	Field expedient repairs	2-28, 2-29	2-150
IX.	Radio interference suppression	2-30, 2-34	2-150, 151
X.	Power plant replacement	2-35, 2-40	2-151, 2-162
XI.	Service instructions for engine mounts, crankcase breather and oil filters	2-41, 2-46	2-166, 2-170
XII.	Vehicle fuel system	2-47, 2-57	2-171, 2-180
XIII.	Engine air induction system	2-58, 2-68	2-183, 2-190
XIV.	Engine exhaust system	2-69, 2-72	2-190, 2-191
XV.	Engine cooling system	2-73, 2-83	2-193, 2-203
XVI.	Alternator and starter	2-84, 2-91	2-204, 2-208
XVII.	Instrument panel cluster switches, indicators and lights	2-92, 2-96	2-208, 2-218
XVIII.	Safety switches, transmitters, and circuit breakers	2-97, 2-100	2-219, 2-222
XIX.	Directional turn signals and horn	2-101, 2-108	2-223, 2-225
XX.	Headlights, taillights, and battery	2-109, 2-122	2-225, 2-230
XXI.	Chassis wiring harness, cables, and receptacles	2-123, 2-125	2-231, 2-235
XXII.	Transmission and transmission oil cooler	2-126, 2-132	2-235, 2-239
XXIII.	Transfer	2-133, 2-137	2-239, 2-241
XXIV.	Propeller shafts	2-138, 2-140	2-242, 2-243
XXV.	Front axle	2-141, 2-148	2-245, 2-255
XXVI.	Rear axle	2-149, 2-153	2-262, 2-264
XXVII.	Brakes	2-154, 2-162	2-265, 2-270
XXVIII.	Air pressure system	2-163, 2-182	2-271, 2-291
XXIX.	Wheels, and tires	2-183, 2-185	2-291, 2-292
XXX.	Steering system	2-186, 2-196	2-293, 2-306
XXXI.	Frame, towing attachments and drawbars	2-197, 2-202	2-306, 2-308
XXXII.	Springs and shock absorbers	2-203, 2-208	2-308, 2-310

Section		Paragraphs	Pages
XXXIII.	Cab and body	2-209, 2-228	2-311, 2-319
XXXIV.	Special purpose bodies	2-229, 2-255	2-319, 2-331
XXXV.	Winch and power takeoff	2-256, 2-264	2-332, 2-338
XXXVI.	Cab and body accessories items	2-265, 2-274	2-338, 2-344
XXXVII.	Speedometer and tachometer	2-275, 2-281	2-344, 2-348

CHAPTER 3. SPECIAL PURPOSE KITS

Section I.	General	3-3, 3-3	3-1
II.	Cold weather kit (−25°F)	3-4, 3-10	3-1, 3-13
III.	Arctic kit (−65°F)	3-11, 3-17	3-13, 3-20
IV.	Slave kit	3-18, 3-21	3-20
V.	Slave (Pershing) kit	3-22, 3-26	3-21, 3-22
VI.	Windshield defogging kit	3-27, 3-33	3-23, 3-28
VII.	100-ampere alternator kit	3-34, 3-40	3-28, 3-32
VIII.	Airbrake hand control kit (M656 and XM791)	3-41, 3-47	3-32, 3-34
IX.	Machinegun mount kit (M656 and XM757)	3-48, 3-54	3-34, 3-37
X.	Hardtop-to-machinegun mount adapter kit (M656 and XM757)	3-55, 3-60	3-37, 3-38
XI.	Soft top-to-machinegun mount adapter kit (M656 and XM757)	3-61, 3-66	3-38, 3-39
XII.	Cargo bow height extension kit (M656)	3-67, 3-70	3-41, 3-43
XIII.	Vehicle slinging kit	3-71, 3-76	3-43, 3-45
XIV.	Tailgate support kit (M656)	3-77, 3-80	3-453
XV.	Seat belt kit	3-81, 3-86	3-46, 3-47

CHAPTER 4. SHIPMENT AND LIMITED STORAGE AND DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

Section I.	Shipment and limited storage	4-1, 4-4	4-1, 4-7
II.	Destruction of materiel to prevent enemy use	4-5	4-8
APPENDIX A.	REFERENCES	A-1, A4 -	----
B.	MAINTENANCE ALLOCATION CHART	B-1, B-2	----
INDEX		----	I-1, I-11

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual contains instructions for the use of organizational personnel maintaining the following vehicles as allocated by the Maintenance Allocation Chart:

Truck, cargo	5-Ton, 8×8, M656
Truck, tractor	5-Ton, 8×8, XM757
Truck, van, expansible	5-Ton, 8×8, XM791

Information is provided on organizational maintenance of the equipment, their accessories, and special purpose kits used in conjunction with the equipment. This manual also includes instructions for shipment and limited storage.

1-2. Forms and Records

a. DA Forms and records used for equipment maintenance will be only those prescribed in TM 38-750.

b. Reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 and forwarded directly to Commanding Officer, U.S. Army Tank—Automotive Command, Attn: AMSTA-TPW Warren, Michigan 48090.

Section II. DESCRIPTION AND DATA

1-3. Description

a. This manual covers the basic vehicles: M656 cargo truck, XM757 tractor truck, and XM791 expansible van truck (figs 1-1 through 1-7).

b. A general description of the vehicles and information pertaining to the major identification plates is contained in TM 9-2320-230-10. A more detailed description of specific components and assemblies of the vehicles is contained in applicable sections of this manual.

1-4. Identification and Tabulated Data

a. Identification Plates. The following paragraphs identify and locate the identification plates mounted on the accessories and small interchangeable components of the vehicle.

Note. The major vehicle identification plates are described in TM 9-2320-230-10.

(1) *Engine plate.* Mounted on the left front side of the engine crankcase and specifies the manufacturer, contract, model, part number, valve lash and static injector advance information.

(2) *Starter plate.* Mounted on the underside of the starter frame and specifies the manufacturer, part number and serial number, model, and voltage rating.

(3) *Air compressor plate.* Mounted on the compressor crankcase and specifies manufacturer, type, serial number, and part number.

(4) *Fuel injection pump plate.* Mounted on rear of fuel injection pump housing and specifies manufacturer, type, capacity, and serial number.

(5) *Injection distributor plate.* Mounted on the injection pump distributor housing and specifies manufacturer, injection sequence, and serial number.

(6) *Turbocharger plate.* Mounted on the

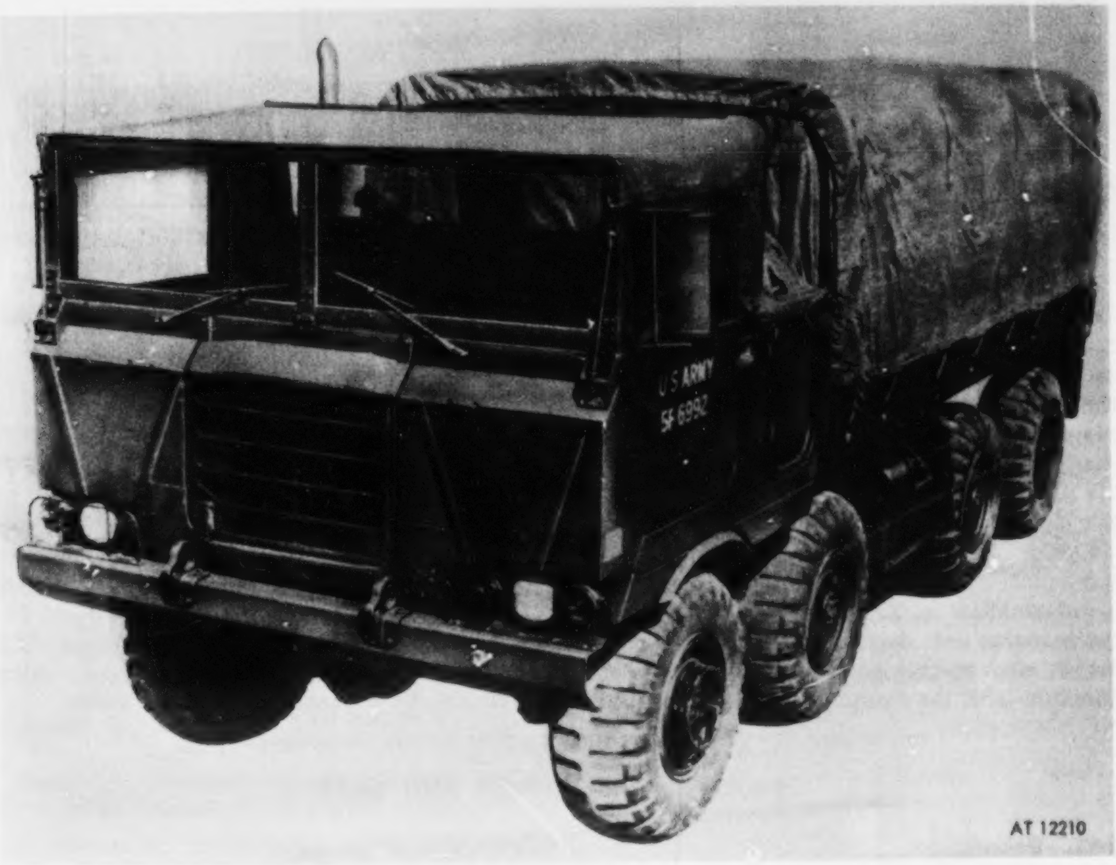


Figure 1-1. 5-Ton, 8 x 8, cargo truck, M656, left front view.

housing and specifies manufacturer, serial number, and part number.

(7) *Flame heater ignition exciter decal.* Located on the exciter and specifies manufacturer, part number, voltage, and amperage.

(8) *Primary fuel filter decal.* Located on the housing and specifies manufacturer, part number, and element part number.

(9) *Final fuel filter decal.* Located on the housing and specifies manufacturer, part number, and element part number.

(10) *Alternator plate.* Mounted on the alternator frame and specifies manufacturer, type, voltage and serial number.

(11) *Radiator plate.* Mounted on the radiator top tank and specifies manufacturer, and model number.

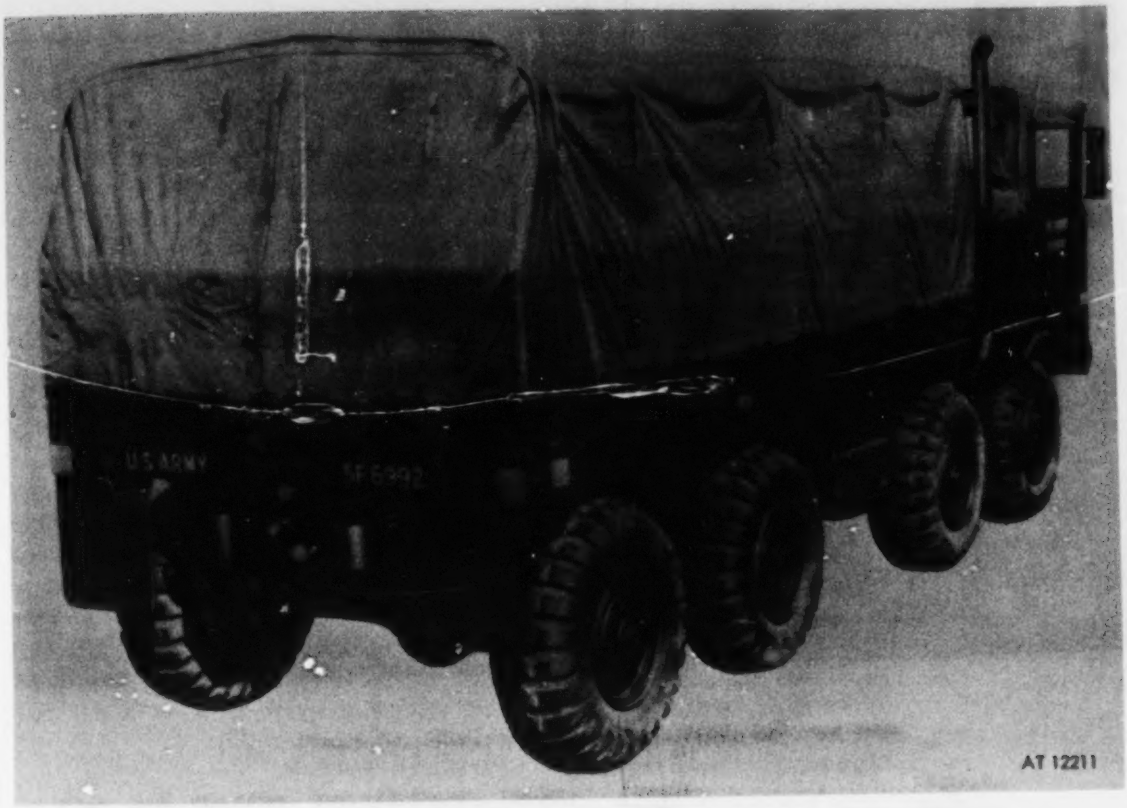
(12) *Transmission plate.* Mounted on right side of housing and specifies manufacturer, and part number.

(13) *Transfer case plate.* Mounted on the front of the transfer case and specifies manufacturer, model, type, and serial number.

(14) *Power steering cylinder plate.* Mounted on the valve housing and specifies manufacturer, model, and serial number.

(15) *Bilge pump plate (M656).* Mounted on end of bilge pump housing and specifies manufacturer, model, type, serial number, voltage, amperage, horsepower, and rpm.

(16) *Axle plate.* Mounted on each axle



AT 12211

Figure 1-2. 5-Ton, 8 x 8, cargo truck, M656, right rear view.

housing and specifies manufacturer, model, ratio, and serial number.

(17) *Cargo box plate* (*M656*). Mounted on right side of cargo box and specifies manufacturer, model, and serial number.

(18) *Van body plate* (*XM791*). Mounted on outside of van in front right lower corner and specifies manufacturer; model, part, serial, and contract number, and delivery date.

(19) *Electric horn plate.* Mounted on front of horn bracket and specifies manufacturer, part number, and manufacturer part number.

(20) *Winch nameplate.* Mounted on bottom of winch frame. Specifies manufacturer, model, capacity, and part number.

b. Tabulated Data.

(1) *Engine dimensions.*

Length	50.39 in.
Width	29.87 in.
Height	42.95 in.

(2) *Engine.*

Make	Continental
Model	LDS 465-2 (Turbocharged)
Type	Six cylinder, inline, OHV liquid cooled Multifuel (Military) Compression-ignition
Part number	11610102
Cycle	4
Displacement	478 cu in.
Horsepower (gross)	200 @ 2800 rpm
Torque (gross)	450 lb-ft @ 1800 rpm
Governed speed	2800 rpm (full load) 3150-3200 rpm (no load)
Bore and stroke	4.56 x 4.87 in.
Compression ratio	22.0 to 1
Firing order	1-5-3-6-2-4
Number of cylinder	6

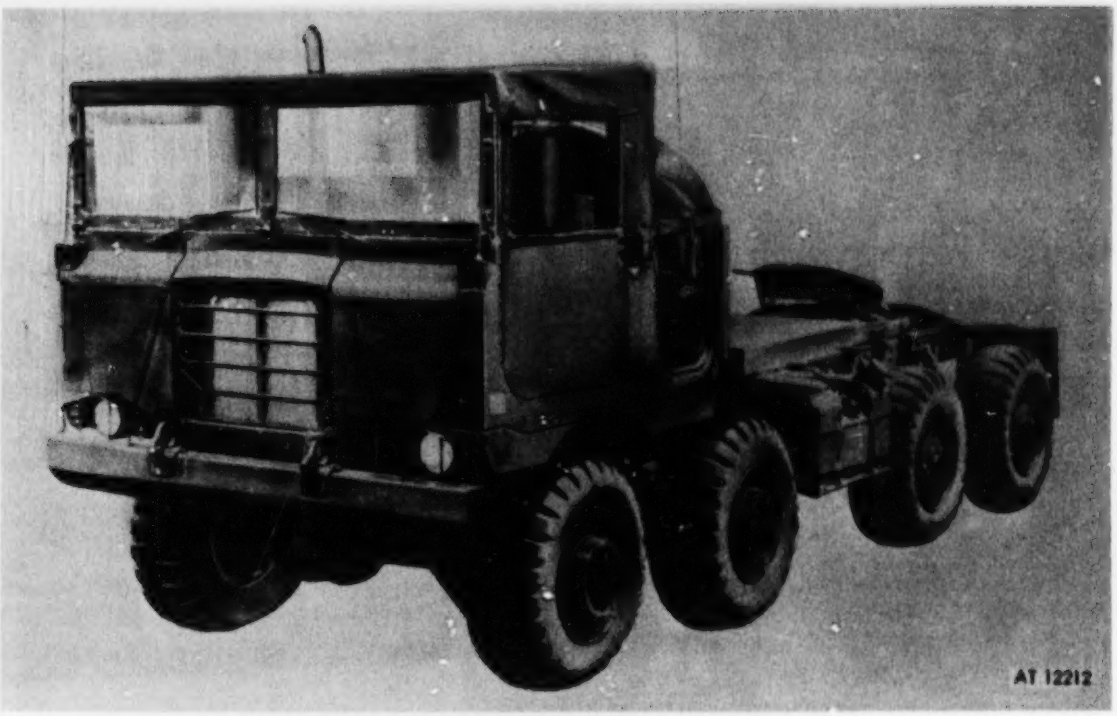


Figure 1-3. 5-Ton, 8 x 8, tractor truck, XM757, left front view.

Crankshaft rotation	Clockwise viewed from fan end
Weight (complete engine)	1578 lbs

(3) *Turbocharger.*

Make	Schwitzer Corp.
Part number	11610447

(4) *Alternator.*

Make	Leece-Neville Co.
Part number	11613630
Rating	30-80 amperes
Voltage	28 volts

(5) *Secondary fuel filter.*

Make	Bendix
Type	Disposable element
Part number (element)	11610298

(6) *Final fuel filter.*

Make	Bendix
Type	Disposable element
Part number (element)	11610298

(7) *Radiator.*

Make	Modine Mfg. Co.
Type	Horizontal fin, vertical tube
Part number	11601425

(8) *Fuel injection pump.*

Make	American Bosch
Part number	11641641
Operating range	650/2800 rpm

(9) *Injection distributor (part of fuel injection pump).*

Make	American Bosch
Type	Single plunger, distributor
Injection sequence	Counterclockwise

(10) *Flame heater ignition exciter.*

Make	Prestolite
Part number	11588687
Voltage	10-30 dc
Amperage	2.0

(11) *Starter.*

Make	Prestolite
Part number	10951385-2
Voltage	24

(12) *Transmission.*

Make	Allison
Model	TX-200-6 (Torque Converter)

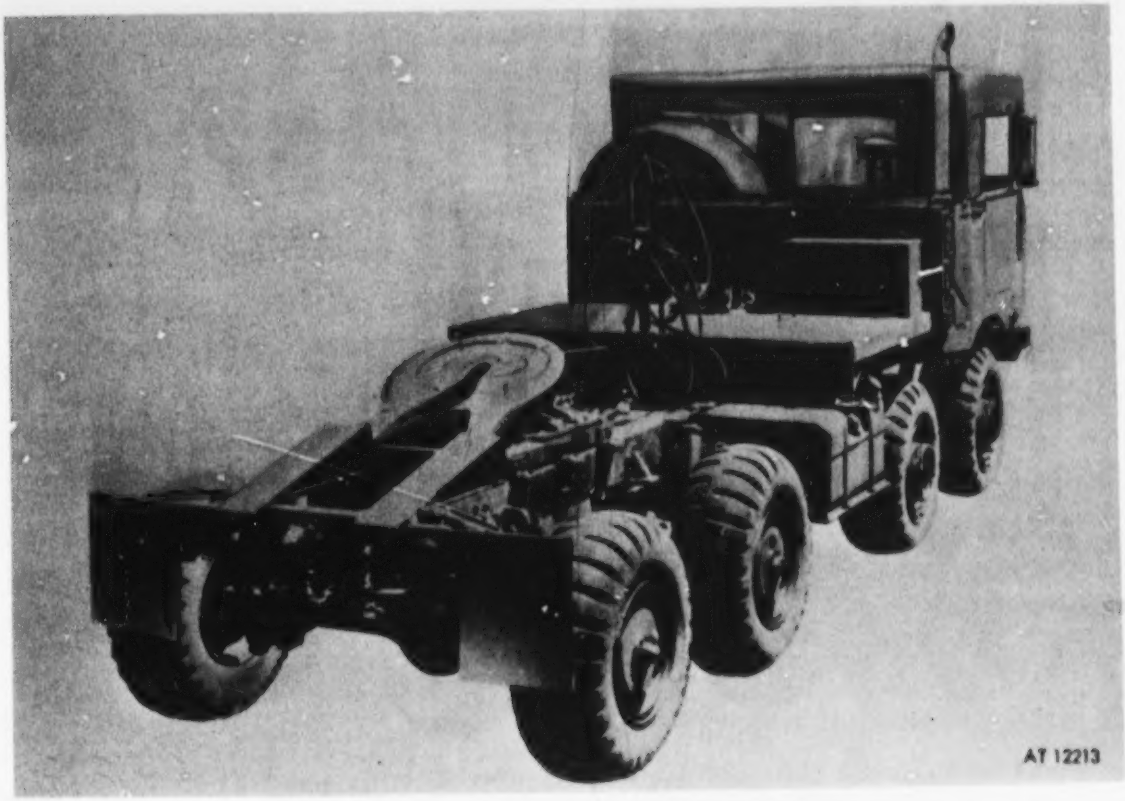


Figure 1-4. 5-Ton, 8 x 8, tractor truck, XM757, right rear view.

Type	Automatic
Number of speeds	6 forward, 1 reverse
Part number	8357182

(13) *Transfer case.*

Make	Dana
Part number	11601806
Number of speeds	1
Ratio	1.044 to 1

(14) *Service brakes.*

Make	Rockwell-Standard
Type	Full air, sealed, internal expanding
Part number	11602480
Size	14 x 3 in.
Adjustment	Self adjusting

(15) *Steering gear.*

Make	Ross Gear
Type	Worm and roller
Gear ratio	20.6 to 1
Part number	11601461

(16) *Steering power cylinder.*

Make	Vickers
Type	Hydraulic
Part number	11601778

(17) *Air compressor.*

Type	Reciprocating, air cooled, 7.25 CFM, Type 1
Part number	MS51322-1

(18) *Handbrake.*

Make	Bendix Products
Type	Internal expanding (transfer output mounting)
Size	12 x 3 in.
Part number	11602247

(19) *Axles.*

Front:	
Make	Rockwell-Standard
Type	Full floating with C.V. universal drive shafts

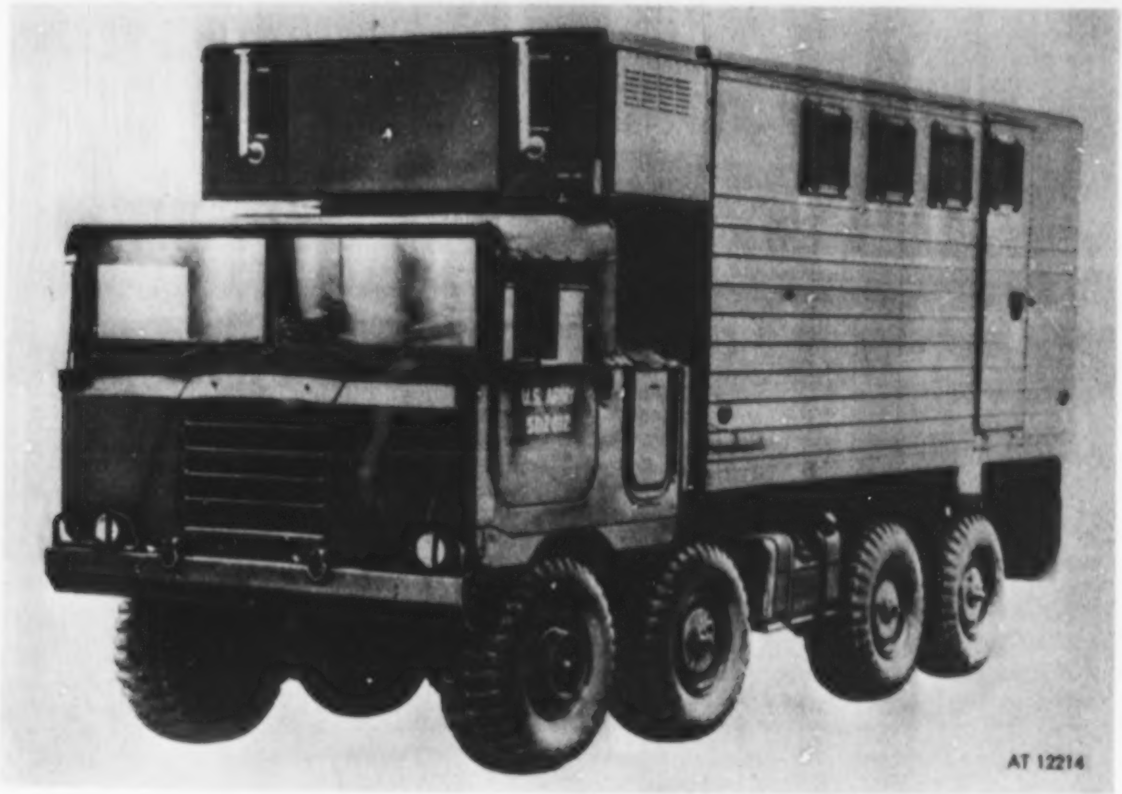


Figure 1-5. 5-Ton, 8 x 8, van truck, XM791, left front view.

Differential	Single speed, double reduction drive-thru, single helical gear with hypoid
Part number (1st axle)	11614033-1
Part number (2nd axle)	11614033-2
Ratio	6.400 to 1

Rear:

Make	Rockwell-Standard
Type	Full floating
Differential	Single speed, double reduction drive-thru, single helical gear with hypoid
Part number	11614034
Ratio	6.400 to 1

(20) *Wheels.*

Make	Budd Wheel
Type	Semi-drop center
Size	12-20 in.
Part number	11600643

(21) *Tires.*

Type	Low profile tubeless
Size	16-20 in.
Ply rating	10
Tread design	Non-directional, cross-country
Part number	11602256

(22) *Frame.*

Type	Ladder
Max section	Depth 9 in. Width 2.80 in.
Section modulus	8.00 in. Thickness 0.224 in.
No. of crossmembers	5

(23) *Cab.*

Type	Cab over engine (open top)
Crew	2 men

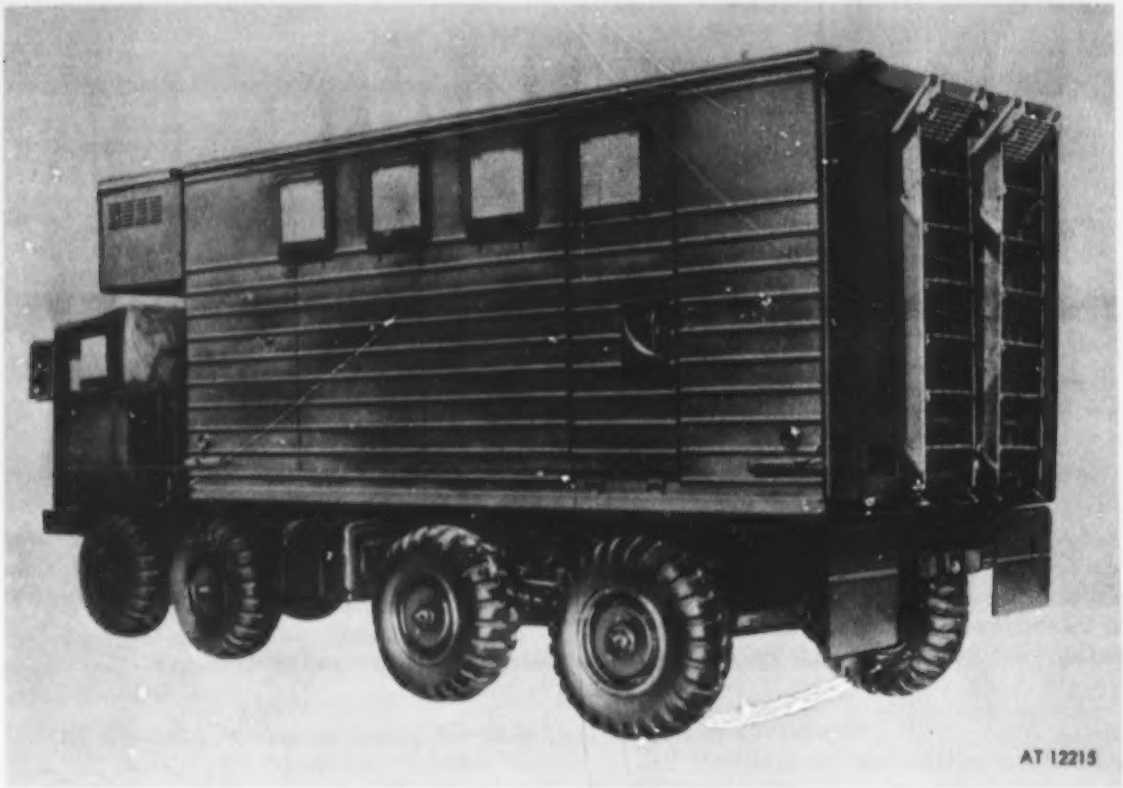


Figure 1-6. 5-Ton, 8 x 8, van truck, XM791, left rear view.

Material	Aluminum with glass windows and 2-piece windshield glass (nylon vinyl impregnated top)

(24) *Cargo body (M656).*

Model	Cargo box (door sides)
Material	Aluminum alloy

(25) *Van body (XM791).*

Type	Shop van
Model	M4 (modified)

(26) *Suspension.*

Type	Parallelogram torque-arm and tapered leaf spring
Spring deflection rate	Clamped 2,500 lb-in.
Shock absorbers	Telescopic type

(27) *Electrical system.*

Lighting system	24 volts
Starting system	24 volts
Batteries (2)	12 volts
Current source	Alternator (30-80 ampere) 28 volts

(28) *Winch.*

Capacity	20,000 lbs
Part number	11613973

(29) *Bilge pump (M656).*

Make	Piqua Machine & Mfg. Co.
Model	32282
Type	Submersible
Part number	8763300-2
Voltage	27.5
Amperage	20
Horsepower	1/3
Rpm	6500

(30) *Horn.*

Part number	MS51074-1
Voltage	24 volt

1-5. Difference in Models

The major differences in models are listed in TM 9-2320-230-10. Where the differences affect organizational maintenance, they are noted in the applicable sections of this manual.

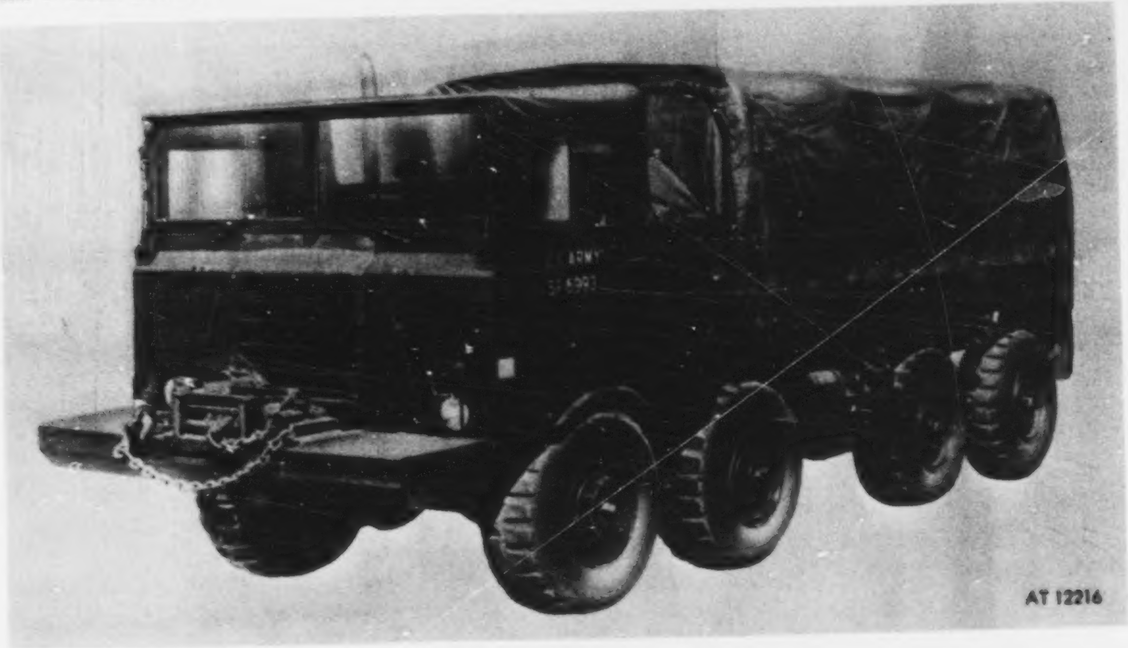


Figure 1-7. 5-Ton, 8 x 8, cargo truck, M656 with front pull winch.

CHAPTER 2

SERVICE AND MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. General Procedures.

(1) When a new or reconditioned vehicle or a vehicle from limited storage or shipment is first received by the using organization and has separately packed components, refer to paragraph 2-2 for installation.

(2) If any exterior surfaces are coated with rust-preventive compound, remove compound with dry-cleaning solvent or mineral spirits paint thinner.

(3) Read the Processing Record for Shipment and Storage of Vehicles and Unboxed Engines (DA Form 9-3) and follow all precautions checked thereon. DA Form 9-3 should be located in the crew compartment attached to either the steering wheel, transmission shift lever, or starting switch.

(4) Check level of coolant in radiator and refer to table 2-1 for checking freezing point of the coolant.

(5) Crank engine with starter at least two revolutions while holding fuel cutoff switch in far right position, to test for hydrostatic lock. This precaution is taken because there might be an excess of preservative oil in the cylinders or other liquids may have leaked into them.

b. Specific Procedures.

(1) Perform the preventive-maintenance checks and services as outlined in section V of this chapter.

Table 2-1. Freezing Points, Composition, and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp. °F	Pints of inhibited glycol per gal. of coolant [1]	Compound, antifreeze Arctic [2]	Ethylene glycol coolant solution specific gravity at 68°F [3]
+20	1½	Issued full strength and ready mixed for 0° to −65°F temperatures for both initial installation and replenishment of losses. DO NOT DILUTE WITH WATER OR ANY OTHER SUBSTANCE.	1.022
+10	2		1.036
0	2¾		1.047
−10	3¼		1.055
−20	3½		1.062
−30	4		1.067
−40	4¼		1.073
−50	Arctic antifreeze preferred		
−60			
−75			

[1] Maximum protection is obtained at 60 percent by volume (4.8 pints of ethylene glycol per gallon of solution).

[2] Military Specification MIL-C-11755 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid-cooled internal combustion engines. It is used for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods close to −40°F or drops below, to as low as −90°F.

[3] Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol antifreeze to 2 parts water. This should produce a hydrometer reading of 0°F.

Note. When antifreeze solution is used, fasten a tag near the radiator filler cap indicating the type antifreeze.

(2) Before starting the road test, lubricate the vehicle in accordance with LO 9-2320-230-12. Lubricate all points regardless of intervals. Check processing tag (DA Form 9-3) to determine viscosity of engine oil. If tag indicates engine oil is not suitable, drain oil and replenish with oil of proper viscosity.

(3) Refer to TM 9-2320-230-10 for vehicle operating instructions. Road test the vehicle for at least 50 miles unless vehicle was driven to using organization. In this case, make the road test only long enough to conduct the usual operations. Stop at least every 10 miles and make visual checks around the vehicle; look particularly for overheated drive and steering components.

(4) After first 1,000 miles of operation, refer to LO 9-2320-230-12 and change transmission oil and filter.

2-2. Installation of Separately Packed Components

a. General. This paragraph covers the instructions necessary for installation of separately packed components.

b. Windshield. Refer to TM 9-2320-230-10 and install windshield.

c. Air Cleaner Cap and Tube Assembly. Refer to paragraph 2-61 and install air cleaner cap and tube assembly.

d. Mirror and Bracket Assembly. Refer to paragraph 2-271 and install two side mirror and bracket assemblies.

e. Spare Tire. Refer to TM 9-2320-230-10 and install tire in tire storage compartment.

f. Cab Soft Top. Refer to TM 9-2320-230-10 and install cab soft top assembly stored in cab.

g. Cargo Box Bows (M 656). Install safety strap brackets on rear roof bow, locate brackets 39-41 inches above cargo box floor. Refer to TM 9-2320-230-10 and install cargo box bows.

h. Cargo Box Cover (M656). Refer to TM 9-2320-230-10 and install cargo box cover.

i. Exhaust Stack. Refer to paragraph 2-72 and install upper engine exhaust pipe.

f. Cab Soft Top. Refer to TM 9-2320-230-10 to paragraph 2-121 and install batteries. Remove battery caps and fill all cells with electrolyte to level of lower ring of the filler necks.

Warning: **Use care not to spill electrolyte on metal or clothing. The electrolyte acid fumes and liquid are injurious to the skin and eyes. Upon contact apply first aid by washing out eyes with cold clean water.**

2-3. Installation or Setting Up Instructions

Refer to TM 9-2320-230-10 for operations performed by the operator or crew in setting up the equipment.

2-4. Equipment Conversion

Refer to TM 9-2320-230-10 for operations performed by the operator in adapting the cargo truck to a troop transport.

Section II. MOVEMENT TO A NEW WORKSITE

2-5. Dismantling for Movement

Refer to TM 9-2320-230-10 for procedure to be followed in dismantling and transporting the XM791 expansible van truck to a new worksite. The M656 cargo truck, and XM757 tractor truck do not require any dismantling for movement.

2-6. Reinstallation After Movement

Refer to TM 9-2320-230-10 for type of location required and operations to be performed in setting up the XM791 expansible van truck. The M656 cargo truck and XM757 tractor truck do not require reinstallation after movement.

Section III. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

2-7. Special Tools and Equipment

a. Special tools and equipment are issued to oranizational maintenance personnel for maintaining the materiel. Tools and equipment are listed in TM 9-2320-230-20P which is the authority for requisitioning replacements.

b. Special tools and equipment issued with or authorized for M656, XM757, and XM791 vehicles are listed in table 2-2 and are shown in figure 2-1. References and illustrations indicating the use of these tools are listed in the table. Maintenance repair parts for organizational maintenance are listed and illustrated in TM 9-2320-230-20P, which is the authority for requisitioning replacements.

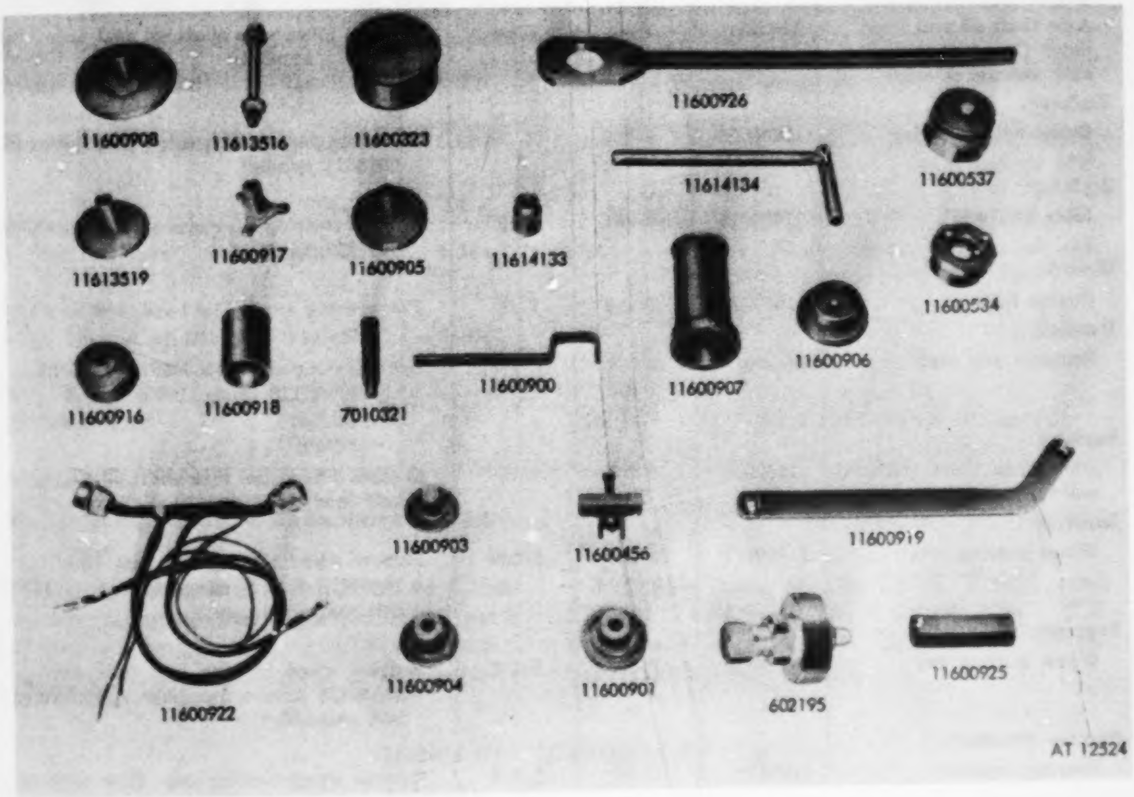

11600908
11613516
11600323
11600926
11600537
11614134
11613519
11600917
11600905
11614133
11600534
11600906
11600907
11600916
11600918
7010321
11600900
11600922
11600903
11600456
11600919
11600904
11600901
602195
11600925
AT 12524

Figure 2-1. Special tools and equipment.

Table 2-2. Special Tools and Equipment

Item	(FSN) or part No.	Reference		Use
		Fig. No.	Para No.	
Replacer: Wheel inner bearing seal	11600907	2-293	2-148	Replace inner wheel bearing seal.
Replacer: Inner and outer wheel bearing seal wiper	11600905	2-296	2-148	Replace inner and outer wheel bearing seal wiper (use with 11600323 fixture assembly and 11613516 bolt assembly).

Table 2–2. Special Tools and Equipment—Continued

Item	(FSN) or part No.	Reference		Use
		Fig. No.	Para No.	
Replacer: Wheel hub seal	11600908	2-297	2–148	Replace wheel hub seal (use with 11600323 fixture assembly and 11613516 bolt assembly).
Replacer: Drive shaft oil seal-outer	11600904	2-291	2–148	Replace outer axle shaft oil seal (use with 7010321 handle).
Replacer: Axle shaft oil seal-front inner (No. 1 and No. 2 axle assemblies only)	11600901	2-292	2–148	Replace inner axle shaft oil seal (use with 7010321 handle).
Replacer: Outer wheel bearing seal	11600906	2–298	2–148	Replace outer wheel bearing seal (use with 7010321 handle).
Replacer: Idler arm seal	11600903	2–361	2–189	Replace steering idler arm oil seal (use with 7010321 handle).
Wrench: Engine barring	11600900	2–115	2–38	For turning engine by hand.
Handle: Remover and replacer	7010321	2–291, 2–292, 2–361	2–148, 2–189	Use with replacers 11600901, 11600903, 11600904, 11600906, 11600916, and 11600918.
Replacer: Differential drive shaft oil seal-inner half	11600916	2–266	2–143	Replace differential thru shaft oil seal-inner half (use with 7010321 handle).
Remover: Wheel bearing cup	11600917	2–288	2–148	Remove wheel bearing cup (use with 11600323 fixture assembly and 11613516 bolt assembly).
Replacer: Wheel bearing cup	11613519	2-295	2–148	Replace wheel bearing cup (use with 11600323 fixture assembly and 11613516 bolt assembly).
Fixture Assembly: Bearing replacer	11600323	2-288	2–148	Remove wheel bearing cup. (Use with bolt assy (11613516).
Bolt Assembly: Bearing replacer	11613516	2–295	2–148	Use with 11600323 fixture assembly.
Replacer: Drive shaft triple lip seal-outer half	11600918	2–267	2–143	Replace differential thru shaft oil seal-outer half (use with 7010321 handle).
Extension: Torque wrench spring "U" bolt nut	11600919	2–380	2–204	Replace spring "U" bolt retaining nut (use with 5120–221–7983 torque wrench).
Adapter: Knockout steering rod end	11614133	2–270	2–144	Remove power steering cylinder anchor stud and tie rod ends (use with 11614134 knockout bar).

Table 2-2. Tools and Equipment—Continued

Item	(FSN) or part No.	Reference		Use
		Fig. No.	Para No.	
Bar:				
Knockout steering rod end	11614134	2-270	2-144	Remove power steering cylinder anchor stud and tie rod ends (use with 11614133 adapter).
Cable Assembly:				
Alternator test adapter	11600922	2-1	Table 2-5	Testing alternator (electrical) (use with TV-100 test set).
Puller Wheel:				
Steering	11600456	2-364	2-190	Remove steering wheel.
Remover:				
Torque rod ball stud	11600925	2-385	2-208	Remove torque rods.
Gage Assembly:				
Wheel bearing preload	11600534	2-299	2-148	Used with wrench, wheel bearing adjusting 11600537. Determine wheel bearing preload.
Wrench:				
Holding end yoke	11600926	2-261	2-142	Remove transfer assy end yoke nut and differential thru shaft yoke nut.
Wrench, Socket:				
Wheel bearing adjusting	11600537	2-300	2-148	Torque gage assembly (use with 11600534 gage assembly).
Puller, Pulley:				
Air compressor	602195 (02978)	2-344	2-178	Remove air compressor belt pulley.

2-8. Organizational Maintenance Repair Parts

a. Repair parts are supplied to organizational maintenance for replacement of parts that become worn, broken, or otherwise unserviceable, provided replacement of the parts is within the scope of organizational maintenance.

b. Repair parts for the M656, XM757, and XM791 vehicles are listed in TM 9-2320-230-20P which is the authority for requisitioning replacements.

Section IV. LUBRICATION

2-9. General

For general lubrication instructions, refer to LO 9-2320-230-12 and TM 9-2320-230-10.

2-10. Special Lubrication Instructions

Any special lubrication of parts and assemblies required during assembly and installation are covered in the pertinent sections of this manual.

Section V. PREVENTIVE-MAINTENANCE CHECKS AND SERVICES

2-11. General

To insure that the vehicle is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive-maintenance checks and services to be performed are listed as described in table 2-3. The table item numbers indicate the sequence of minimum inspection requirements. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2408 at the earliest possible opportunity.

2-12. Responsibility

The organizational maintenance personnel is responsible for performing the "S" semiannual preventive-maintenance services listed in table 2-3.

2-13. Purpose

The "S" preventive-maintenance services insure the correct adjustment, securing, and assembly of all components of the materiel. Necessary replacements, cleaning, lubrication, and protection of parts and/or assemblies will be accomplished as required, to give reasonable assurance of trouble-free operation until the next "S" preventive-maintenance service is performed.

2-14. Intervals

The semiannual "S" preventive-maintenance services are performed by the organizational mechanics every 6 months or at every 6000 miles of vehicle operation, whichever occurs first.

2-15. Specific Procedures for Organizational Maintenance

Specific procedures for performing each item in the semiannual "S" preventive-maintenance services on materiel are outlined in table 2-3. Result of inspection and checking during preventive-maintenance services is authorization to take corrective action to remove the trouble found, by performing the service or repair at organizational-maintenance level. If repairs by a higher category of maintenance are required, a DA Form 2407, Maintenance Request, will be prepared and forwarded with the equipment to the supporting maintenance activity.

2-16. General Procedures

a. The following general procedures apply to preventive-maintenance services and to all inspections, and are just as important as the specific procedures.

b. Inspect to see if items are in good condition, correctly assembled or stowed, secure, not excessively worn, not leaking, and adequately lubricated (apply to most items in the preventive-maintenance and inspection procedures). Any or all of these checks that are pertinent to any item (including supporting, attaching, or connecting members) will be performed automatically, as general procedures, in addition to any specific procedures given.

(1) Inspection for "good condition" is usually a visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. Good condition means that a component or part is not bent or twisted, not chafed or burred, not broken or cracked, not bare, or frayed, not dented or collapsed, not torn or cut, or not deteriorated.

(2) Inspection of an item to see that it is correctly assembled or stowed is usually a visual inspection to see if the item is in its normal position in the vehicle and if all its parts are present and in their correct relative position.

(3) Inspection of an item to determine if it is "secure" is usually a visual examination or a check by hand, wrench, or pry-bar for looseness. Such an inspection must include any brackets, lockwashers, locknuts, locking wires, or cotter pins as well as any connecting tubes, hoses, or wires.

(4) By "excessively worn" is meant worn beyond serviceable limits or to a point likely to result in failure if the item is not replaced before next scheduled inspection. Excessive wear of mating parts or linkage connections is usually evidenced by too much play (lash or lost motion). It includes illegibility as applied to markings, data, and caution plates.

(5) Where the instruction "tighten" appears in the procedure, it means tighten with a wrench, even if the item appears to be secure.

(6) Such expressions as "adjust if necessary" or "replace if necessary" are not used in the specific procedures. It is understood that whenever inspection reveals the need of ad-

justment, repairs or replacement, the necessary action will be taken.

c. For special cleaning instructions, refer to sections of TM 9–208–1 pertinent to specific components, and the following information:

(1) Use dry-cleaning solvent (SD) or mineral spirits paint thinner to clean or wash grease or oil from all medal parts.

(2) A solution of one part grease-cleaning compound to four parts of dry-cleaning solvent or mineral spirits paint thinner may be used for dissolving grease and oil from engine castings, components, and engine compartments. After cleaning, use cold water to rinse off any solution which remains on the item being cleaned.

(3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of lubricating oil to all unprotected metal surfaces to prevent rusting.

(4) When authorized to install new parts, remove any preservative materials, such as rust-preventive compound, grease, etc., prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in LO 9–2320–230–12.

d. General precautions in cleaning are as follows:

(1) Dry-cleaning solvent (SD) or mineral spirits paint thinner is flammable and should not be used near an open flame. Fire extinguishers should be provided nearby when these materials are used. Use only in well-ventilated places.

(2) These cleaners evaporate quickly and have a drying effect on the skin. If used continuously without gloves, cracks in the hand and, in the case of some individuals, a mild irritation or inflammation of the skin may result.

(3) Avoid getting petroleum products, such as dry-cleaning solvent, mineral spirits paint thinner, engine fuels, or lubricants, on rubber parts as they will deteriorate rubber which is not resistant to petroleum.

(4) The use of diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

(5) The use of water, steam, or air under high pressure for cleaning the interior of the cab or van body is prohibited.

e. To prevent formation of mildew, shake out and air the paulin covers for several hours at frequent intervals. Have any loose grommets or rips in the fabric repaired without delay. Failure to make immediate repairs may allow a minor defect to develop into a major damage. Mildew is best cleaned from fabric by scrubbing with a dry brush. If water is necessary to remove dirt, it must not be used until all mildew has been removed. If mildew is present, examine fabric carefully for evidence of rotting or weakening of fabric. If fabric shows indication of loss of tensile strength, it is probably not worth retreatment. If not damaged, retreat the fabric. Oil and grease can be removed by scrubbing with issue soap and warm water. Rinse well with clear water and dry.

f. Nameplates, caution plates and instruction plates may corrode rapidly. When they are found to be in a corroded condition, they should be thoroughly cleaned and given a heavy coat of lacquer.

g. When the materiel is not in use, the proper covers must be used.

2–17. Specific Procedures

The "S" semiannual preventive-maintenance checks and services for the vehicle are listed in table 2–3, Preventive-Maintenance Checks and Services.

TABLE 2-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
Perform prior to road test and after daily preventive maintenance services according to Operator's Manual.			
1	Tires	Check tires for unusual wear or damage, particularly at tire tread. Check closely for cracks or breaks in tire sidewalls which could lead to future defects or blowouts. Check tire pressure (30 psi).	Para 2-184*b*.
2	Wheels	Check wheels for damage. Inspect tire side rings for security and damage. Check wheel mounting nuts for tightness (tighten to 250-270 lb-ft).	Para 2-184*c*.
	M656 CARGO BODY		
3	Gates (Side and Tail)	Check operation of side and tailgates. Inspect gate hinges, seals, and latches for alinement, operation and damage.	Para 2-226.
4	Cargo Box	Check cargo box mounting brackets for secureness. Tighten front mount to obtain 6.00 to 6.50 inch spring length. Tighten remaining mount support bolt to 40-45 lb. ft. torque.	Paras 2-225, 2-267.
5	Body Tarpaulin and Bows	Inspect body tarpaulin for tears, chafing and deterioration. Check snaps, zippers, straps, lashing and other securing devices for damage, installation and operation. Check tarpaulin bows for correct fit and installation. Inspect bows for bends, breaks or damage.	Para 2-267.
	CAB		
6	Canopy, Bows and Rods	Inspect canopy for tears, chafing and other damage. Check snaps, straps, zippers and other securing devices. Check cab bow and rods for correct fit, bent or broken condition.	Para 2-266.
7	On-Vehicle Equipment and Stowage.	Determine if all on-vehicle equipment is present and in serviceable condition. Check stowage boxes for damage and secure insulation. Check fit and operation of stowage box access doors.	Para 2-224.
8	Engine Cooling System	Check coolant level in radiator. Inspect radiator, water pump and hoses for leaks. Check hoses for deterioration and hose clamps for tightness. Check drive belts for excessive wear, cracks or other damage. Check for proper belt tension 80-100 lbs. (3/8-inch deflection). Inspect radiator core for obstructions and bent fins which might affect air circulation.	Para 2-75.
9	Engine Air Cleaner	Inspect air cleaner indicator, and with engine running, note position of indicator band. Remove air cleaner inlet cover, run engine at 1,200 rpm and slowly slide a piece of clean board across inlet opening until approximately 90 percent of the	Paras 2-59, 2-60.

TABLE 2-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
		opening is covered. Observe indicator to make sure the indicator band is functioning properly (the red band should be visible). Check filter element, air ducts and clamps for damage and secureness.	
10	Engine and Engine Compartment.	Inspect engine compartment for indication of water, oil or fuel leaks. Check engine and transmission oil levels. Operate engine and check for any unusual noise(s). Check all visible moving parts for damage or indication of a malfunction. Check throttle linkage for excessive wear and proper operation. Check engine gages and instruments for proper operation and normal readings. Inspect engine covers for damage. Check seals for defects and inspect operation of locking devices.	Para 2-40*f*.
11	Engine Starter Assembly	Start engine several times and note operation of the starter, starter solenoid and starter switch. Be alert for noise which may indicate a malfunction or damage. Inspect starter wiring for damage and dirty or loose terminals.	Paras 2-85*b*, 2-90.
12	Vehicle Batteries	Check each cell of the batteries for proper electrolyte level. Check batteries for proper charge using a battery hydrometer. Check for loose corroded post clamps or cable terminal bolts.	Para 2-121.
13	Engine Lubrication (Oil, Filters, Oil Cooler and Oil Lines).	Inspection oil filters, oil cooler and oil lines for leaks and damage. Check all oil line fittings for tightness.	Paras 2-44, 2-46.
14	Air Compressor	Check compressor drive belt for wear, damage and proper tension (80-100) pounds) (3/8-inch deflection). Inspect compressor and air lines for damage and security. Operate engine and check operation of compressor. Be alert for unusual noises. Check air lines for leaks and operation of the warning buzzer and unloader governor.	Para 2-179.
15	Generating System (Alternator and Wiring).	Check alternator drive belts for wear, damage and proper tension (75-90 pounds) (3/8-inch deflection). Inspect alternator and wiring for damage and loose terminal connections. Operate engine and check alternator output.	Paras 2-86, 2-87, & 2-88.
16	Fuel Tank(s), Strainer(s), Filters, Sending Unit(s), and Electric Fuel Pump(s).	Inspect fuel tank(s), fuel strainer housings and filters for leaks, dents, cracks, deteriorated welds or other damage. Check mounting and secureness of all components. Inspect fuel lines for damage, chafing and leaks. Turn on engine switch and check operation of electric fuel	Paras 2-48 through 2-54.

TABLE 2–3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
		pump(s) and fuel gage. Inspect fuel pump and sending unit wiring for damage and loose terminal connections. Check tank filler cap(s) for proper fit and tank vent line(s) for damage and being open.	
17	Engine Exhaust System	Operate engine and inspect engine manifold and exhaust pipe for leaks. Check for damaged pipes, loose clamps and blown gaskets or seals. Check all mounting clamps for tightness.	Paras 2–69 through 2–72.
18	Crankcase Ventilation System	Check crankcase ventilation tube for carbon buildup and clogged condition.	Para 2–45.
19	Steering	Check oil level in steering oil reservoir. Inspect oil pump, power cylinder and lines for damage and leaks. Operate engine and check operation of steering system. Be alert for leaks, ease of operation and any indication of a malfunction. Check steering gear lube. Drain water at lower steering column.	Paras 2–191, 2–192.
20	Transmission	Inspection transmission case for damage and indication of oil leaks. Check transmission linkage for damage and excessive wear or play. Check oil level. Operate engine and shift transmission through all speed ranges; check operation and be alert for unusual noises. Inspect transmission oil cooler for damage and leaks; check oil lines and fittings for damage and tightness.	Para 2–126.
21	Differentials	Inspect differentials for damage and indication of oil leaks. Check oil level. Check flanges, propeller shaft universal joints for looseness, damage or malfunction.	Para 2–142.
22	Parking Brake, Speedometer Cable and Adapter.	Inspect parking brake lining, drum and linkage for damage and excessive wear. Apply brake and check operation and adjustment. Inspect speedometer cable and adapter for damage and tightness.	Paras 2–153, 2–154.
23	Air Reservoirs and Air Lines	Check air reservoirs, air lines, manifolds and fittings for damage and leaks. Open reservoir cocks and check for accumulated water.	Para 2–165.
24	Controls, Gages and Instruments.	Operate and warm up engine. Check all gages and instruments for proper reading and operation. Check operation of windshield wipers and horn. Check condition of all operating controls. Inspect bilge pumps and their wiring harnesses for damage and secureness. Remove bilge pump and clean any debris from suction	Para 2–93.

TABLE 2-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
		strainer elbows. Operate bilge pumps, being alert forany unusual noises or malfunction(s).	
25	Vehicle Light	Operate vehicle light switches and check operation of all lights. All lights must operate properly before and after engine operation.	Para 2-93.
26	Drain Plugs and Access Plates	Check all drain plugs and access plates for damage, evidence of leaks and secure fit. Inspect seals and gaskets of all access plates for defects.	Paras 2-168, 2-226.
		Road Test The road test should be conducted over varied terrain and should be of sufficient mileage and duration to permit a complete analysis and evaluation of the vehicle performance under all anticipated driving conditions.	
27	Engine	Check operation of engine at all speeds. Observe engine power and response to accelerator feed. Observe engine instruments to determine signs of malfunction. Be alert for any unusual noise(s) or other indications of engine malfunction.	Paras 2-40*f*, 2-93.
28	Transmission	Operate vehicle in all speed ranges. Check for transmission response and smoothness of operation. Be alert for any unusual noise(s) and for any difficulty encountered while shifting or driving in any speed range. Check vehicle in various speed ranges utilizing front and rear axle drives. Check overall stability of vehicle during all tests requiring vehicle movement.	Para 2-126.
29	Steering	Check power steering system operation through complete steering range and on level straight terrain for wander or other malfunction. Vehicle should respond instantly to action of the steering wheel; be alert for hard steering, steernig backlash, shimmy, and road wander during the road test.	Paras 2-191, 2-192.
30	Brakes	Check brake pedal for freedom of movement. Accelerate vehicle to a moderate speed and apply brakes with a steady force. Vehicle should stop smoothly and effectively without noticeable side-pull, chatter or other unusual noises. When brake pedal is released the wheel brake should release immediately and without difficulty. With vehicle on an incline and	Para 2-155.

TABLE 2-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
		transmission in neutral, the handbrake should when applied hold the vehicle in place.	
		After Road Test	
31	Engine, Transmission and Vehicle Drive Units.	Inspect chassis for lubrication leaks and damage. If engine, transmission, transfer case, differentials, or other parts of the vehicle drive assembly require service or repair, notify direct support maintenance personnel.	Paras 2-40*f*, 2-126 & 2-142.
32	Wheel and Tires	Check wheels for tightness. Inspect tires for damage. Check each tire for proper air pressure (30 lbs).	Para 2-184.
33	Vehicle Lights	Test operation of all vehicle lights.	Para 2-93.
34	Cargo Bed and Cab	Inspect side and tailgates for secureness and fit. Check cab for loose engine covers and access plates. Check doors for secureness and fit.	Paras 2-225, 2-267.
35	Lubrication	Check oil levels in all components and replenish as necessary. Refer to LO 9-2320-230-12. Perform necessary lubrication procedures in accordance with the Lubrication Order. Record lubrication interval on Preventive Maintenance Roster.	Para 2-44, 2-46.
		Additional Maintenance Service Checks	
36	Modifications	Check vehicle DA Form 2408-5 and determine if all modifications have been incorporated. Enter any modification or major replacement performed during this service.	Para 2-11.
37	Final Road Test	After all services and inspections have been completed, take the vehicle on a short road test to make sure that corrections of operational difficulties have been accomplished. Correct any defects or malfunctions that may occur on this test run.	

Section VI. TROUBLESHOOTING VEHICLE

2-18. General

a. This section provides information on vehicle troubleshooting useful in diagnosing and correcting unsatisfactory operation or failure of the M656 cargo truck, XM757 tractor truck and the XM791 expansible van truck and their components. Malfunctions which may occur are listed in Table 2-4, Troubleshooting the Vehicle, and Table 2-5, Troubleshooting the Electrical System. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

b. This manual cannot cover all possible troubles and deficiencies that may occur under the many conditions of operation. If a specific trouble, test, and remedy are not covered herein, proceed to isolate the system in which the trouble occurs and then locate the defective component. Do not neglect use of any test instruments such as voltmeter, ammeter, test lamp, hydrometer, and pressure and vacuum gages that are available. Standard automotive theories and principles of operation apply in troubleshooting the vehicle. Question vehicle driver or operator to obtain mximum number of observed symptoms. The greater the number of symptoms of troubles that can be evaluated, the easier will be the isolation of the defect.

2-19. Procedures

Table 2-4 and 2-5 list possible malfunctions that may be experienced during the operation of this vehicle or its components. Each malfunction is followed by a list of probable causes that may be considered in determining the action necessary to correct the malfunction. Probable causes are listed in their order of probability and should be considered in that manner during troubleshooting.

Table 2-4. Troubleshooting the Vehicle

Malfunction	Probable causes	Corrective action
	ENGINE TROUBLES	
1. Engine fails to crank when master switch is held in start position.	*a.* Battery(ies) "dead", not charged.	*a.* Refer to Electrical Troubleshooting.
	b. Defective electrical wiring or electrical system.	*b.* Refer to Electrical Troubleshooting.
	c. Defective starter.	*c.* Replace starter assembly (para 2-90).
	d. Hydrostatic lock or mechanical seizure within the engine.	*d.* Notify direct support maintenance personnel.
2. Engine cranks, but fails to start-adequate fuel in fuel tank.	*a.* Defective electrical fuel pump in fuel tank.	*a.* Refer to Electrical Troubleshooting.
	b. Starter cranking speed too slow.	*b.* Refer to Electrical Troubleshooting.
	c. Clogged fuel strainer or fuel filter.	*c.* Service fuel strainer and/or fuel filter. Replace filter element if necessary (para 2-52).
	d. Air entrapped in fuel filters.	*d.* Bleed fuel filters (para 2-52).
	e. Intake air manifold too cold—(cold weather starting below +30° R).	*e.* Intake air manifold heater not operating. Refer to table 2-5.
	f. Injection (engine) fuel pump not operating.	*f.* Notify direct support maintenance personnel.
Note. Refer to Electrical Troubleshooting for all electrically operated engine components.		
3. Engine starting motor operates but does not engage flywheel.	*a.* Broken starter pinion gear and/or drive assembly.	*a.* Replace starter assembly (para 2-90).
	b. Starter solenoid mechanism not operating properly.	*b.* Replace starter assembly (para 2-90).
	c. Ring gear on engine flywheel has stripped teeth.	*c.* Notify direct support maintenance personnel.
4. Engine manifold heater fails to operate when turned "on".	*a.* Defective electrical wiring or electrical components.	*a.* Refer to Electrical Troubleshooting.
	b. Damaged or restricted fuel heater nozzle.	*b.* Clean or replace nozzle as required (para 2-67).
	c. Restricted heater fuel filter.	*c.* Replace filter (para 2-66).
	d. Restricted fuel line.	*d.* Clean or replace fuel line as necessary (para 2-65).

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	ENGINE TROUBLES—Continued	
	e. Defective manifold heater pump.	*e.* Replace manifold heater pump (para 2-65).
5. Engine starts and runs, but misfires (does not run smoothly). Exhaust may contain considerable amount of bluish-white smoke.	*a.* Dirty engine air cleaner.	*a.* Service air cleaner (para 2-60).
	b. Water or dirt in fuel filter.	*b.* Service fuel filters and/or replace filter elements as necessary (para 2-52).
	c. Dirty or stuffed fuel nozzle.	*c.* Notify direct support maintenance personnel.
	d. Blown engine cylinder head gasket.	*d.* Notify direct support maintenance personnel.
	e. Sticking, warped, or burned engine valves.	*e.* Notify direct support maintenance personnel.
	f. Defective or improperly adjusted fuel injection pump assembly.	*f.* Notify direct support maintenance personnel.
	g. Turbocharger not operating properly.	*g.* Notify direct support maintenance personnel.
6. Engine does not develop full power; exhaust pipe may emit puffs of black smoke.	*a.* Dirty engine air cleaner.	*a.* Service air cleaner (para 2-60).
	b. Defective electrical fuel pump	*b.* Refer to Electrical Troubleshooting.
	c. Defective or improperly adjusted injection pump assembly.	*c.* Notify direct support maintenance personnel.
	d. Defective turbocharger.	*d.* Notify direct support maintenance personnel.
	e. Defective engine valve timing	*e.* Notify direct support maintenance personnel.
	f. Broken or badly worn piston rings.	*f.* Notify direct support maintenance personnel.
	g. Defective fuel nozzle.	*g.* Notify direct support maintenance personnel.
	h. Fuel return valve sticking.	*h.* Notify direct support maintenance personnel.
7. Engine runs properly at no-load, but appears to be low on power when under load.	*a.* Fuel pump fuse blown.	*a.* Replace fuse (para 2-49).
	b. Electrical fuel pump defective, not delivering maximum fuel delivery.	*b.* Replace pump (para 2-48).
	c. Fuel filter partially clogged.	*c.* Service fuel filters (para 2-52).
	d. Injection pump not properly timed.	*d.* Notify direct support maintenance personnel.
8. Engine overheats, as indicated by coolant temperature gage.	*a.* Fan belts loose, badly worn or broken.	*a.* Check fan belt tension (3/8 inch deflection), adjust or replace belts as necessary (para 2-81).
	b. Insufficient coolant fluid.	*b.* Replenish as required. Refer to LO 9-2320-230-12 and paragraph 2-75 of this manual.
	c. Clogged radiator fins.	*c.* Clean and straighten as necessary.
	d. Defective or stuck coolant thermostat.	*d.* Replace coolant thermostat (para 2-83).
	e. Partially clogged radiator.	*e.* Clean or replace radiator as necessary. Refer to item 15 below.
	f. Defective gage or transmitter.	*f.* Refer to Electrical Troubleshooting.
	g. Improper injection timing, late cylinder combustion.	*g.* Notify direct support maintenance personnel.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	ENGINE TROUBLES—Continued	
9. Engine oil pressure low as indicated by oil pressure gage.	*a.* Engine oil low.	*a.* Replenish oil as necessary. Refer to LO 9-2320-230-12.
	b. Wrong viscosity of oil.	*b.* Change engine oil. Refer to LO 9-2320-12.
	c. Oil regulator defective.	*c.* Notify direct support maintenance personnel.
	d. Oil cooler partially clogged.	*d.* Notify direct support maintenance personnel.
	e. Defective gage or transmitter.	*e.* Refer to Electrical Troubleshooting.
	f. Loose or badly worn engine bearings.	*f.* Notify direct support maintenance personnel.
10. Engine oil consumption excessive.	*a.* External oil leak.	*a.* Inspect engine, tighten or replace components or gaskets as necessary.
	b. Improper oil viscosity.	*b.* Change engine oil. Refer to LO 9-2320-230-12.
	c. Worn engine valve guides.	*c.* Notify direct support maintenance personnel.
	d. Worn or broken piston rings.	*d.* Notify direct support maintenance personnel.
11. Engine will not shut off when engine shutoff control is activated.	*a.* Fuel shutoff solenoid not operating properly.	*a.* Check fuel shutoff solenoid. Refer to Electrical Troubleshooting.
	b. Defective electrical system.	*b.* Refer to Electrical Troubleshooting.
ENGINE FUEL, AIR INTAKE AND EXHAUST TROUBLES		
12. Insufficient engine fuel (adequate fuel in tank).	*a.* Dirty fuel filter.	*a.* Service fuel filters (para 2-52).
	b. Defective electrical fuel pump.	*b.* Check fuel pump fuse and/or replace electrical fuel pump (para 2-50).
	c. Clogged or kinked fuel line.	*c.* Clean, repair, or replace fuel line as necessary (para 2-56).
	d. Defective fuel injection assembly.	*d.* Notify direct support maintenance personnel.
13. Insufficient engine air.	*a.* Air cleaner restricted.	*a.* Service air cleaner (para 2-60).
	b. Restricted air inlet duct.	*b.* Remove restriction or replace duct as necessary.
	c. Restricted exhaust system.	*c.* Remove restriction or replace component(s) as necessary.
	d. Sticking engine air inlet valves.	*d.* Notify direct support maintenance personnel.
	e. Defective turbocharger.	*e.* Notify direct support maintenance personnel.
	f. Loose, damaged or cracked engine air intake manifold.	*f.* Notify direct support maintenance personnel.
14. Leaking or excessive back pressure in engine exhaust system.	*a.* Bent or restricted exhaust pipe.	*a.* Straighten, clean or replace exhaust pipe (para 2-70).
	b. Cracked or blown exhaust pipe seal or engine gasket.	*b.* Replace damaged seal gasket.
	c. Defective or cracked turbocharger.	*c.* Notify direct support maintenance personnel.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
ENGINE FUEL, AIR INTAKE AND EXHAUST TROUBLES—Continued		
	d. Defective, cracked or loose engine exhaust manifold.	*d.* Notify direct support maintenance personnel.
Warning: Exhaust gases are dangerous. Troubleshoot exhaust system in well ventilated area to preclude injury or death to personnel.		
15. Insufficient engine cooling.	*a.* Low coolant level.	*a.* Replenish coolant as necessary. Refer to LO 9-2320-230-12.
	b. Leaking radiator.	*b.* Replace radiator (para 2-76).
	c. Leaking radiator hose.	*c.* Tighten hose clamp or replace hose as necessary (para 2-78).
	d. Loose or broken fan belt.	*d.* Check belt tension (3/8 inch deflection). Tighten or replace belt as necessary (para 2-81).
	e. Defective coolant pump.	*e.* Replace pump (para 2-82).
	f. Defective thermostat.	*f.* Replace thermostat (para 2-83).
	g. Restricted coolant system.	*g.* Refer to TM 9-2858 to test coolant system, determine cause and corrective action.
ENGINE LUBRICATION SYSTEM		
16. Insufficient engine oil.	*a.* Wrong viscosity of oil (too light).	*a.* Drain engine oil and replace with proper grade of oil. Refer to LO 9-2320-230-12.
	b. Leak in oil cooler or line.	*b.* Replace oil cooler or oil line as necessary (para 2-130).
	c. Leaking oil pan or pan gasket.	*c.* Notify direct support maintenance personnel.
	d. Worn or damaged piston oil rings.	*d.* Notify direct support maintenance personnel.
	e. Worn valve guides.	*e.* Notify direct support maintenance personnel.
INSTRUMENT PANEL GAGE TROUBLES		
17. Air pressure gage does not indicate proper air pressure.	*a.* Defective air pressure gage.	*a.* Replace air pressure gage (para 2-94).
	b. Defective air separator.	*b.* Replace separator (para 2-173).
	c. Restricted air line.	*c.* Remove restriction or replace line as necessary.
	d. Governor not functioning properly.	*d.* Adjust or replace governor (para 2-180).
18. Speedometer does not register.	*a.* Broken speedometer cable.	*a.* Replace broken cable (para 2-277).
	b. Disconnected cable housing.	*b.* Clean and connect cable housing.
	c. Stripped drive gear.	*c.* Notify direct support maintenance personnel.
	d. Defective bulkhead adapter.	*d.* Replace bulkhead adapter (para 2-277*c* and 2-281*a*).
	e. Defective speedometer.	*e.* Replace speedometer (para 2-94*b*).
19. Tachometer does not register.	*a.* Broken tachometer cable.	*a.* Replace broken cable (para 2-277*b* and 2-281*b*).
	b. Disconnected cable housing.	*b.* Clean and connect cable housing.
	c. Defective right angle drive adapter.	*c.* Replace right angle drive adapter (para 2-277*d*).

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
INSTRUMENT PANEL GAGE TROUBLES—Continued		
	d. Defective tachometer.	*d.* Replace tachometer (para 2-94*c*).
	e. Defective bulkhead adapter.	*e.* Replace bulkhead adapter (para 2-277*d* and 2-281*b*).
TRANSMISSION TROUBLES		
20. Excessive transmission oil consumption.	*a.* Oil leaks.	*a.* Inspect transmission oil cooler, oil lines, gaskets and plugs.
	b. Defective bearing seal or bearing retainer cover gasket.	*b.* Notify direct support maintenance personnel.
	c. Converter seal leak; oil in flywheel housing.	*c.* Notify direct support maintenance personnel.
21. Contaminated transmission oil.	*a.* Improperly installed or damaged oil filter element.	*a.* Replace filter element (para 2-127). Refill transmission. Refer to LO 9-2320-230-12.
	b. Excessive heat developed during vehicle operation.	*b.* Check transmission oil cooler and thermostat. Replace cooler and/or thermostat if clogged or damaged (para 2-128).
22. No response to movement of transmission range selector lever.	*a.* Broken or disconnected selector linkage.	*a.* Adjust and connect linkage. Replace broken or damaged parts as necessary (para 2-131 and 2-132).
	b. Transmission converter failure (stator free wheeling).	*b.* Notify direct support maintenance personnel.
	c. Transmission failure.	*c.* Notify direct support maintenance personnel.
23. Transmission heats up in all drive ranges.	*a.* Transmission oil cooler restricted.	*a.* Remove restriction or replace oil cooler as necessary (para 2-76).
	b. Low oil level.	*b.* Refill as necessary. Refer to LO 9-2320-230-12.
	c. High oil level.	*c.* Drain transmission to proper level. Refer to LO 9-2320-230-12.
	d. Defective oil cooler thermostat.	*d.* Replace thermostat (para 2-128).
	e. Clogged radiator fins.	*e.* Remove restrictions, straighten radiator fins as necessary.
24. Excessive noise (may occur intermittently).	*a.* Low oil level.	*a.* Add oil to proper level. Refer to LO 9-2320-230-12.
	b. Filter element clogged.	*b.* Replace element (para 2-127).
	c. Air leak at transfer lines or seals in oil filter element cover.	*c.* Replace transfer line and/or seals in element cover.
25. Excessive vehicle creep in all speed ranges when engine is idling.	*a.* Engine idling speed too fast.	*a.* Adjust engine idle speed (para 2-57*c* and 2-57*d*).
	b. Transmission oil too heavy.	*b.* Drain and replace transmission oil and filter. Refer to LO 9-2320-230-12.
26. Vehicle moves forward when in neutral range.	*a.* Range selector linkage not properly adjusted.	*a.* Adjust selector linkage (para 2-131).
	b. Defective or improperly adjusted range clutch.	*b.* Notify direct support maintenance personnel.
27. Vehicle moves backward when selector is in neutral.	*a.* Range selector linkage not properly adjusted.	*a.* Adjust selector linkage (para 2-131).
	b. Defective reverse range clutch.	*b.* Notify direct support maintenance personnel.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	TRANSMISSION TROUBLES—Continued	
28. Slippage in reverse gear range; functions properly in all forward ranges.	*a.* Defective reverse range clutch.	*a.* Notify direct support maintenance personnel.
	b. Excessive oil leakage at reverse range clutch piston seal.	*b.* Notify direct support maintenance personnel.
29. Slippage in all forward gear ranges.	*a.* Low oil level in transmission.	*a.* Refill transmission as necessary. Refer to LO 9-2320-230-12.
	b. Lockup clutch slipping.	*b.* Notify direct support maintenance personnel.
	c. Defective converter assembly.	*c.* Notify direct support maintenance personnel.
30. Transmission shifts too slowly in all automatic shift ranges at full throttle.	*a.* Throttle valve linkage not properly adjusted.	*a.* Adjust valve linkage (para 2-57*e* and 2-132).
	b. Clutch pressure low (low main pressure) clogged filter element.	*b.* Change filter element (para 2-127).
31. All shift points too high except lockup and first to second range.	Defective transmission (rear pitot tube loose).	Notify direct support maintenance personnel.
32. Vehicle slow to start moving in all lockup speed ranges.	*a.* Transmission oil level low.	*a.* Refill as necessary. Refer to LO 9-2320-230-12.
	b. Defective transmission (low oil pressure).	*b.* Notify direct support maintenance personnel.
	c. Clogged oil filter element.	*c.* Replace oil filter element (para 2-127).
33. Misses second gear in downshift to low range.	*a.* Manual shift performed at too low a vehicle speed.	*a.* Down-shift at proper vehicle speed. Refer to TM 9-2320-230-10.
	b. Defective transmission (low oil pressure).	*b.* Notify direct support maintenance personnel.
	c. Defective splitter relay valve.	*c.* Notify direct support maintenance personnel.
34. Transmission will not shift into fourth gear in 3-4, 3-5 or 3-6 range positions.	*a.* Rear pitot tube loose or damaged.	*a.* Refer to item 31 above.
	b. Rear pitot splitter plug sticking.	*b.* Notify direct support maintenance personnel.
35. Rough transmission shifting.	*a.* Range selector linkage out of adjustment.	*a.* Adjust transmission selector linkage (para 2-131 and 2-132).
	b. Transmission valve linkage out of adjustment.	*b.* Adjust transmission valve linkage (para 2-131 and 2-132).
	c. Sticking or defective transmission valves.	*c.* Notify direct support maintenance personnel.
36. Engine overspeeds on full throttle shift out of transmission low range.	*a.* Down-shift timing valve defective.	*a.* Notify direct support maintenance personnel.
	b. Transmission clutch piston and seals worn.	*b.* Notify direct support maintenance personnel.
37. Excessive slippage and chatter noise in any selected speed range and/or gear lockup.	*a.* Contaminated oil (worn or burned).	*a.* Drain oil and refill with proper lubricant. Refer to LO 9-2320-230-12.
	b. Internal seals and/or clutch failure.	*b.* Notify direct support maintenance personnel.
	TRANSFER CASE TROUBLES	
38. Noisy transfer.	*a.* Insufficient lubricant.	*a.* Refill to proper level. Refer to LO 9-2320-230-12.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	TRANSFER CASE TROUBLES—Continued	
	b. Worn or broken gear bearing, or shaft.	*b.* Notify direct support maintenance personnel.
39. Transfer will not shift.	*a.* Air shift control line restricted or kinked.	*a.* Clean, repair or replace air line as necessary.
	b. Air shift control valve damaged (not operating).	*b.* Notify direct support maintenance personnel.
	c. Broken transfer shift fork.	*c.* Notify direct support maintenance personnel.
40. Excessive oil consumption.	*a.* Loose bearing cap studs or plugs.	*a.* Tighten studs or plugs as necessary.
	b. Worn oil seals.	b. Notify direct support maintenance personnel.
	c. Cracked case or broken housing gasket.	*c.* Notify direct support maintenance personnel.
	d. Leak in air shift valve.	*d.* Notify direct support maintenance personnel.
	PROPELLER SHAFT(S) TROUBLES	
41. Backlash and noisy propeller shaft(s).	*a.* Damaged or broken universal joint bearings or cups.	*a.* Replace universal joints (para 2-140).
	b. Loose capscrews.	*b.* Tighten or replace capscrews as necessary (para 2-140).
	c. Work shaft spline.	*c.* Replace propeller shaft (para 2-140).
42. Vibration in propeller shaft(s).	*a.* Damaged or worn universal joint.	*a.* Replace universal joint (para 2-140).
	b. Bent propeller shaft.	*b.* Replace propeller shaft (para 2-140).
	c. Worn slip joint spline.	*c.* Replace propeller shaft (para 2-140).
	SUSPENSION TROUBLES	
43. Vehicle leans to one side.	Broken spring leaf.	Replace spring (para 2-204).
44. Noise in suspension system.	*a.* Worn or broken torque rod assembly.	*a.* Replace torque rod as necessary (para 2-208).
	b. Damaged shock absorber.	*b.* Replace shock absorber as necessary (para 2-207).
	c. Broken or worn shock absorber bushings.	*c.* Replace damaged or worn bushings (para 2-207).
	d. Loose or broken spring "U" bolts.	*d.* Tighten (800–850 lb-ft) or replace "U" bolts as necessary (para 2-204).
	e. Broken or damaged axle bump stops.	*e.* Replace axle bump stops as necessary (para 2-206).
	f. Broken vehicle spring leaf.	*f.* Replace spring (para 2-204).
	BILGE PUMP TROUBLES	
45. Bilge pump(s) fails to operate when switch is turned on.	*a.* Electrical system or motor failure.	*a.* Refer to Electrical Troubleshooting.
	b. Inoperative switch.	*b.* Replace switch (para 2-95*d*).
	c. Broken or worn motor brush.	*c.* Replace motor brush as necessary (para 2-273*b*).

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	BILGE PUMP TROUBLES—Continued	
46. Bilge pump operates but fails to pump.	*a.* Clogged inlet screen or elbow.	*a.* Clean screen or elbow as necessary.
	b. Broken pump impeller.	*b.* Replace damaged pump (para 2-273).
	CAB AND CARGO BOX TROUBLES	
47. Windshield wiper does not operate properly.	*a.* Loose connection or break in air line to motor.	*a.* Tighten connection or repair air line as necessary.
	b. Defective control valve.	*b.* Replace control valve (para 2-270*a*).
	c. Defective wiper motor.	*c.* Replace wiper motor (para 2-269).
48. Windshield wiper does not clean windshield.	*a.* Defective wiper blade.	*a.* Replace blade as necessary (para 2-268).
	b. Grease or oily substance on windshield.	*b.* Clean windshield and wiper blade. Replace blade if necessary (para 2-268).
	c. Wiper arm not properly adjusted.	*c.* Adjust wiper arm (para 2-268).
49. Cab leaks water during swimming operation (M656 vehicle).	*a.* Door seals not properly inflated.	*a.* Check for leaking air lines. Repair or replace air lines as necessary.
	b. Defective or broken door air seal.	*b.* Replace door seal (para 2-220).
	c. Defective pressurization control valve or pressure regulator.	*c.* Replace defective component (para 2-95).
	d. Engine cover seal defective.	*d.* Replace defective seal.
	e. Engine covers misalined or not fitted properly.	*e.* Aline and fit engine covers and tighten securing screws.
	f. Spare tire access cover or engine access plate seals leak.	*f.* Replace access plate seals as necessary (para 2-228).
	g. Holes in cab floor, or damaged miscellaneous small line or cable seals.	*g.* Check for leaks and repair as necessary.
50. Cargo box leaks water during swimming operation.	*a.* Tail and side gate seals not inflated.	*a.* Check for defective pressurization valve. Replace valve if necessary (para 2-228).
	b. Defective or damaged tail or side gate seal.	*b.* Replace seal as necessary (para 2-226).
	c. Leaking, broken, or clogged pressurization line.	*c.* Repair, clean or replace line as necessary.
	d. Tail or side gate not properly closed or alined.	*d.* Check fit and alinement of tail or side gate and repair as necessary.
51. Cab door does not close properly.	*a.* Sprung or bent door hinge.	*a.* Straighten hinge or replace as necessary (para 2-211).
	b. Defective, misalined or broken door latch.	*b.* Repair, aline or replace door latch as necessary (para 2-212).
52. Cargo box tail or side gate does not close properly.	*a.* Spring or bent hinges.	*a.* Replace hinges as necessary (para 2-241).
	b. Misalinement of gate.	*b.* Aline and refit gate.
	c. Defective or damaged gate latch.	*c.* Notify direct support maintenance personnel.
53. Cab window does not operate.	*a.* Broken or stripped window regulator.	*a.* Replace window regulator (para 2-215).
	b. Regulator arms out of window rail channel.	*b.* Correctly install and adjust window regulator (para 2-216).

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	TRAILER BRAKE TROUBLES	
54. **Trailer brakes do not actuate when service brake is applied.**	*a.* Trailer airhose not connected.	*a.* **Connect trailer airhose.**
	b. Service-air shutoff valve closed.	*b.* **Open service valve.**
	c. Tractor-trailer protection control valve in "Emergency" position.	*c.* **Reposition control valve to normal position.**
	d. Defective double check valve.	*d.* **Replace check valve (para 2-170*f*).**
55. **Trailer brakes do not actuate when hand control valve is operated.**	*a.* Defective hand control valve.	*a.* **Replace hand control on steering column (para 2-172).**
	b. Trailer hose not connected or shutoff valve closed.	*b.* **Refer to item 54*a* above.**
	c. Defective tractor-trailer protection or double check valves.	*c.* **Refer to item 54*c* and *d* above.**
	SERVICE BRAKES	
56. **Brakes do not apply.**	*a.* No pressure in air system.	*a.* **Inspect air lines, hoses and fittings for leakage. Repair or replace air lines and hoses as necessary. Refer to para 2-165.**
	b. Broken or disconnected air lines.	*b.* **Replace broken air lines. Connect air lines.**
	c. Defective or worn air compressor drive belt.	*c.* **Replace defective or worn drive belt. Refer to para 2-178.**
	d. Defective treadle valve.	*d.* **Repair or replace defective treadle valve. Refer to para 2-171.**
	e. Defective automatic brake shoe adjusting mechanism.	*e.* **Notify direct support maintenance personnel.**
57. **Brakes apply but braking is not adequate.**	*a.* Leakage in air system.	*a.* **Inspect air lines and fittings for leaks. Repair as necessary. Refer to para 2-165.**
	b. Defective treadle valve	*b.* **Repair or replace treadle valve. Refer to para 2-171.**
	c. Glazed brakeshoe lining.	*c.* **Replace brakeshoes. Refer to para. 2-156*b*.**
58. **Brakes apply too slowly.**	*a.* Low pressure in air system.	*a.* **Inspect air lines, hoses and fittings for leaks. Repair or replace lines as necessary. Refer to para 2-165.**
	b. Leak in wheel air chamber.	*b.* **Notify direct support maintenance personnel.**
	c. Inoperative air brake hand control valve. (XM757)	*c.* **Replace hand control valve. Refer to para 2-172.**
	d. Ice from condensed water in air lines, hoses or air reservoir.	*d.* **Place vehicle in a warm building. Bleed water from air system.**
59. **Brakes do not release.**	*a.* Quick release valve damaged.	*a.* **Notify direct support maintenance personnel.**
	b. Defective treadle valve.	*b.* **Repair or replace treadle valve. Refer to para 2-171.**
60. **Brakes release too slowly.**	*a.* Restriction in air lines or hoses.	*a.* **Inspect air lines and hoses for damage or restriction. Replace parts as necessary. Refer to para 2-165.**
	b. Damaged or inoperative treadle valve.	*b.* **Replace or repair treadle valve. Refer to para 2-171.**

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	SERVICE BRAKES—Continued	
	c. Broken or damaged brake shoes, return spring or anti-rattle rods.	*c.* Inspect wheel brake assembly for damaged brake shoes, return springs or anti-rattle rods. Replace damaged parts. Refer to para 2-156*b*.
61. Grabby brakes.	*a.* Grease or oil on brake shoe linings.	*a.* Replace brake shoes. Refer to para 2-156*b*.
	b. Loose or broken brake shoe lining.	*b.* Replace brake shoes. Refer to para 2-156*b*.
	c. Scored or cracked brake drum.	*c.* Replace damaged brake drum. Refer to para 2-148.
	d. Seized wheel bearing.	*d.* Replace wheel bearings, bearing cups and wheel bearing seals. Refer to para 2-148.
62. Uneven braking.	*a.* Brake shoe lining glazed or worn.	*a.* Replace glazed or worn brake shoes. Refer to para 2-156*b*.
	b. Scored or cracked brake drum.	*b.* Replace damaged brake drum. Refer to para 2-148.
	c. Grease or oil on brakeshoe lining.	*c.* Replace brake shoes. Refer to para 2-156.
	d. Drum out of round.	*d.* Replace brake drum. Refer to para 2-148.
	e. Loose or seized wheel bearings.	*e.* Adjust wheel bearing preload. Refer to para 2-148. Replace seized wheel bearings, bearing cups and wheel bearing seals. Refer to para 2-148.
	f. Brakeshoe lining loose or cracked.	*f.* Replace brake shoes. Refer to para 2-156*b*.
	g. Water in brake drums after fording or swimming.	*g.* Drain water from brake drums. Check bearings and seals for damage. Replace as necessary.
	STEERING	
63. Excessive tire wear.	*a.* Incorrect tire pressure.	*a.* Inflate tires (30 psi).
	b. Improper wheel toe-in.	*b.* Adjust toe-in. Refer to para 2-196.
	c. Wheel brake dragging.	*c.* Inspect wheel brake assembly. Replace damaged parts. Refer to para 2-148.
	d. Loose or worn tie rod ball joints.	*b.* Install new tie rod ends. Refer to para 2-188.
64. Vehicle wanders when driving.	*a.* Incorrect tire pressure.	*a.* Inflate tires (30 psi).
	b. Loose or worn tie rod ball joints.	*b.* Install new tie rod ends. Refer to para 2-188.
	c. Improper wheel alignment.	*c.* Check and adjust wheel alignment. Refer to para 2-196.
65. Vehicle pulls to one side.	*a.* Incorrect tire pressure.	*a.* Inflate tires (30 psi).
	b. Wheel bearing adjustment to tight or seized wheel bearing.	*b.* Check and adjust wheel bearing pre-load. Replace seized wheel bearing. Refer to para 2-148.
	c. Weak or broken spring.	*c.* Replace spring. Refer to para 2-204.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	STEERING—Continued	
	d. Wheel brake dragging.	*d.* Inspect wheel brake assembly. Replace damaged parts. Refer to para 2–148.
66. Road sway when driving.	*a.* Incorrect tire pressure.	*a.* Inflate tires (30 psi)
	b. Loose or worn shock absorbers.	*b.* Replace worn or damaged shock absorbers. Refer to para 2–207.
	c. Weak or broken spring.	*c.* Replace spring. Refer to para 2–204.
67. Erratic steering.	*a.* Sticking power steering cylinder piston.	*a.* Replace steering power cylinder assembly. Refer to para 2–193.
	b. Loose idler arm bracket assembly.	*b.* Tighten idler arm bracket assembly or replace if damaged. Refer to para 2–189.
68. Vehicle shimmy.	*a.* Loose or damaged wheel bearing.	*a.* Replace damaged wheel bearing. Adjust wheel bearing pre-load. Refer to para 2–148.
	b. Loose or damaged tie rod ball joints.	*b.* Replace tie rod ball joints. Refer to para 2–188.
	c. Steering gear pitman arm loose or badly worn.	*c.* Notify direct support maintenance personnel.
	d. Defective steering power cylinder.	*d.* Replace steering power cylinder assembly. Refer to para 2–193.
69. Hard steering.	*a.* Defective steering power cylinder.	*a.* Replace steering power cylinder assembly. Refer to para 2–193.
	b. Steering gear binding.	*b.* Notify direct support maintenance personnel.
	c. Fluid low in steering reservoir.	*c.* Refer to LO TM 9-2320-230-12 and replenish fluid in reservoir.
	FRONT SUSPENSION	
70. Noise in one or more wheels.	*a.* Loose or damaged wheel bearings.	*a.* Adjust pre-load on loose bearings. Replace damaged wheel bearings and bearing cups. Refer to para 2–148.
	b. Loose brake shoe, broken return spring, broken anti-rattle rod.	*b.* Replace damaged sealed brake components as necessary. Refer to para 2–156.
71. Noise in one or more axle ends.	*a.* Badly worn or cracked steering knuckle bushings.	*a.* Replace worn or cracked knuckle bushings. Refer to para 2–146.
	b. Improper adjustment on spindle knuckle bushing.	*b.* Check for proper shims in spindle knuckle. Adjust as necessary. Refer to para 2–146.
	c. Scored or seized wheel bearings.	*c.* Replace scored or seized wheel bearing, bearing cups and seals. Refer to para 2–148.
	d. Badly worn or damaged axle c.v. joint or axle shaft.	*d.* Inspect axle shaft assembly. Replace axle shaft and c.v. joint. Refer to para 2–145.
72. Front bogie axles do not track.	*a.* Bent tie rod.	*a.* Replace tie rod and tie rod ends. Refer to para 2–188.
	b. Improper toe-in.	*b.* Check and adjust toe-in. Refer to para 2–196.

Table 2-4. Troubleshooting the Vehicle—Continued

Malfunction	Probable causes	Corrective action
	FRONT SUSPENSION—Continued	
	c. Worn or damaged reach rods on tie rod ball joints.	*c.* Replace worn or damaged reach rod. Refer to para 2-187. Replace tie rod ball joints. Refer to para 2-188.
73. Vehicle leans to one side with no load.	*a.* Broken spring or spring leaf.	*a.* Replace broken spring. Refer to para 2-204.
74. Noisy spring action.	*a.* Broken spring leaf.	*a.* Replace broken spring. Refer to para 2-204.
	b. Damaged or badly worn spring seat bushings.	*b.* Replace spring seat bushings. Refer to para 2-205.
	PARKING BRAKE	
75. Parking brake will not hold vehicle on incline.	*a.* Parking brake linkage out of adjustment.	*a.* Adjust parking brake linkage. Refer to para 2-162.
	b. Brake shoes improperly adjusted.	*b.* Adjust parking brake shoes. Refer to para 2-160.
	c. Brake shoe lining worn.	*c.* Replace brake shoes. Refer to para 2-159.
	d. Brake drum scored or cracked.	*d.* Replace brake drum. Refer to para 2-159.
	e. Corroded or damaged brake actuating mechanism. Brake can not be fully applied.	*e.* Replace or repair damaged parts.
76. Parking brake drags and overheats brake drum.	*a.* Parking brake partially applied.	*a.* Release brake hand lever, check linkage adjustment. Refer to para 2-162.
	b. Broken or loose brake shoes.	*b.* Replace brake shoes. Refer to para 2-159.
	c. Brake lever or linkage out of adjustment.	*c.* Adjust brake linkage. Refer to para 2-162.
	d. Warped or cracked brake drum.	*d.* Replace brake drum. Refer to para 2-158.
	e. Brake shoes improperly adjusted.	*e.* Adjust brake shoes. Refer to para 2-159.

Section VII. TROUBLESHOOTING THE ELECTRICAL SYSTEM

2-20. General

a. This section contains detailed troubleshooting information for locating and correcting malfunctions in the electrical systems of the M656 cargo truck, XM757 tractor truck and the XM791 expansible van truck. Each of the functional systems is treated separately, by means of:

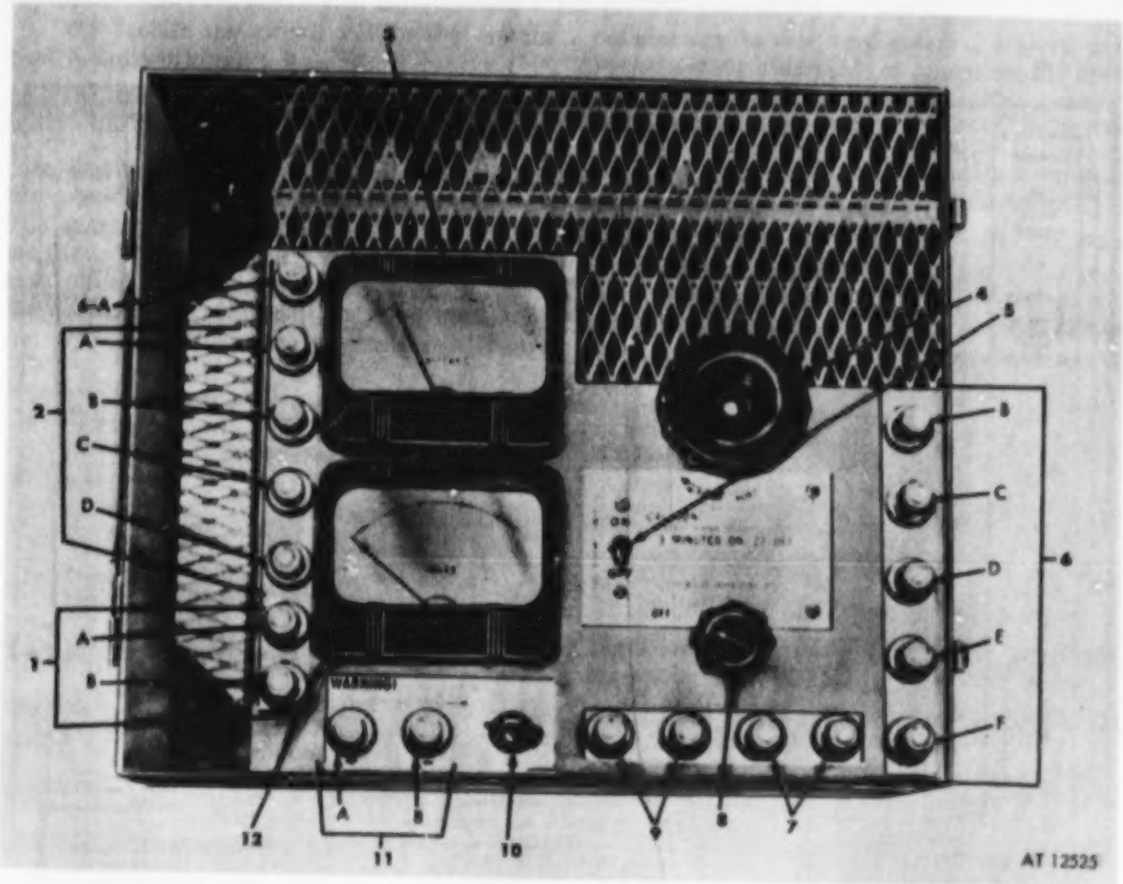
(1) A physical and functional description.

(2) A brief overall system check to determine if the complete system is operating properly.

(3) An illustration showing the location on the vehicle of the major components of the system.

(4) A simplified circuit diagram to clarify circuits, circuit components and disconnect points.

(5) Step-by-step tests to diagnose trouble, using authorized test equipment.



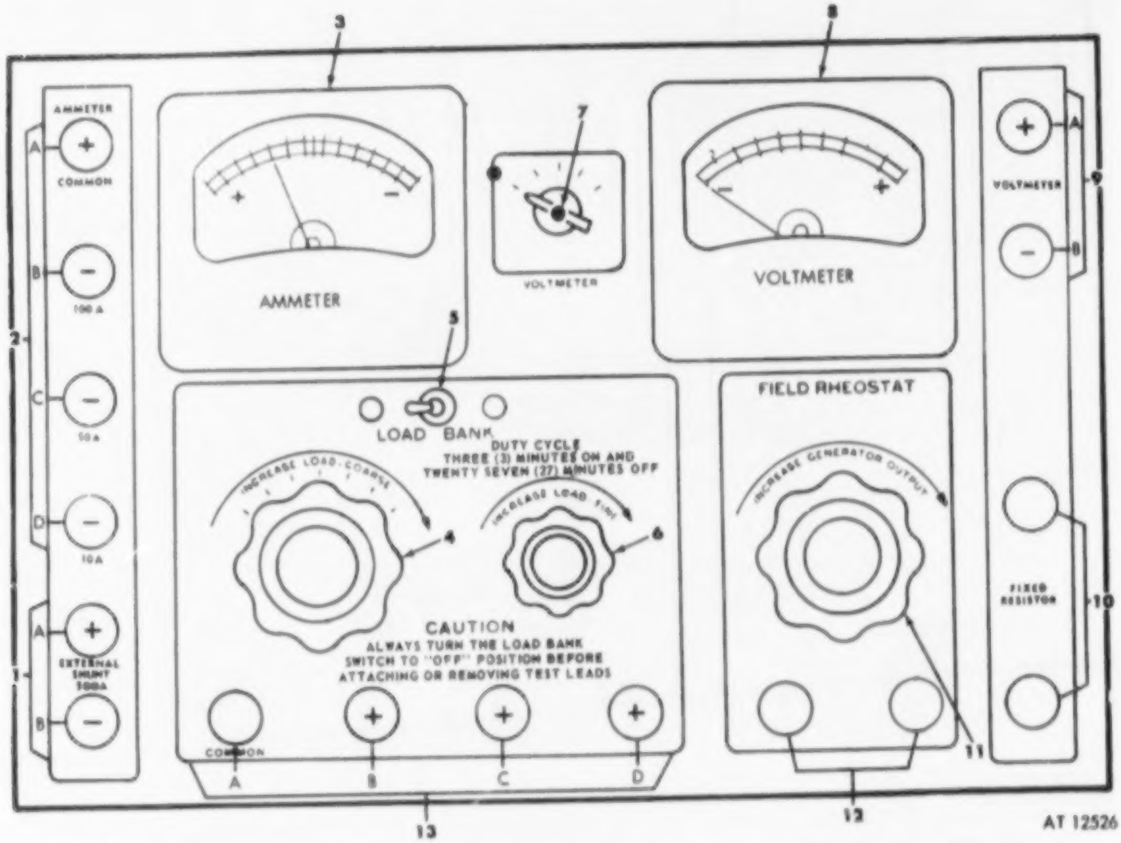
1—External shunt binding posts
  A—Negative
  B—Positive
2—Ammeter binding posts
  A—Positive
  B—100 amp negative
  C—50 amp negative
  D—10 amp negative
3—Ammeter
4—Load bank control
5—Load bank switch
6—Load bank binding posts
  A—Common
  B—6 volts, 5–100 A
  C—12 volts, 50–100A
  D—12 volts, 5–50 A—24 volts, 80–100 A
  E—24 volts, 10–80 A
  F—24 volts, 5–10 A
7—1/4-ohm resistor binding posts
8—Field rheostat control
9—Field rheostat binding posts
10—Voltmeter range selector switch
11—Voltmeter binding posts
  A—Positive
  B—Negative
12—Voltmeter

Figure 2–2. Low voltage circuit tester TV–100.

b. This section also includes a list of electrical circuit numbers with a brief description of each, and a complete vehicle circuit diagram of the M656 cargo truck, XM757 tractor truck and the XM791 expansible van truck (figs. 2–80 through 2–82).

Note. Electrical leads on the vehicle are marked with a circuit-numbered metal band attached to the junction or terminal end of each lead.

Warning: **Because of their higher power capabilities, 24-volt systems are more dangerous to components than 6- or 12-volt systems. Certain precautions must be observed before beginning any tests on the 24-volt system. Do not permit a "hot" wire to touch metal parts of the vehicle at any time. "Flash" testing by striking a hot wire against a vehicle ground will cause an arc that will completely destroy the connector on the lead. Accidental contact of metal tools between battery or starter cables and the frame of the vehicle causes a direct short circuit resulting in arcing and instant**


3
8
7
AMMETER
COMMON
100 A
50 A
10 A
EXTERNAL SHUNT 100A
A
B
C
D
A
B
2
1
AMMETER
VOLTMETER
VOLTMETER
5
LOAD BANK
DUTY CYCLE
THREE (3) MINUTES ON AND
TWENTY SEVEN (27) MINUTES OFF
INCREASE LOAD-COARSE
INCREASE LOAD FINE
4
6
CAUTION
ALWAYS TURN THE LOAD BANK
SWITCH TO "OFF" POSITION BEFORE
ATTACHING OR REMOVING TEST LEADS
COMMON
A
B
C
D
13
FIELD RHEOSTAT
INCREASE GENERATOR OUTPUT
11
12
VOLTMETER
9
A
B
FIXED RESISTOR
10
AT 12526

1—External shunt binding posts
  A—Positive
  B—Negative
2—Ammeter binding posts
  A—Positive
  B—100 amp negative
  C—50 amp negative
  D—10 amp negative
3—Ammeter
4—Load bank control, coarse
5—Load bank switch
6—Load bank control, fine
7—Voltmeter range selector switch
8—Voltmeter
9—Voltmeter binding posts
  A—Positive
  B—Negative
10—1/4-ohm resister binding posts
11—Field rheostat control
12—Field rheostat binding posts
13—Load bank binding posts
  A—Common
  B—6 volts
  C—12 Volts
  D—24 Volts

Figure 2-3. Low voltage circuit tester EMC 1060.

heating of the tool. This can cause painful burns on the hands and serious damage to tools, vehicle components and batteries. Moreover, the overloaded battery may explode, spraying hot acid and sharp fragments over the surrounding area. The correct procedure when removing electrical equipment, harnesses, battery cables or starter cables, is to disconnect the battery ground cable first. Protect the ground cable from accidental contact with the battery terminal. When the work has been completed, connect the battery ground cable last.

2-21. System Circuits

a. To successfully troubleshoot the electrical system, analyze the entire system as follows:

(1) Attempt to isolate the system (lighting, starting, etc.) in which the malfunction occurs.

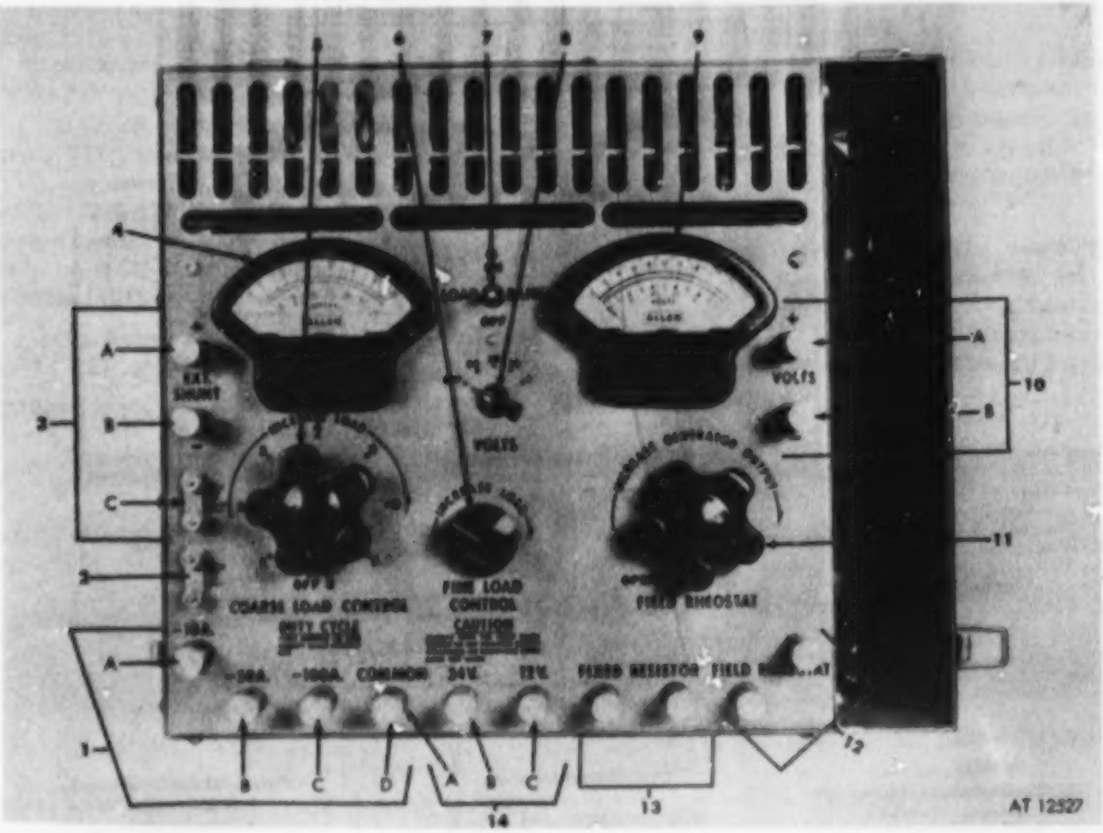
(2) Isolate the circuit within the system that is not working.

(3) Isolate the individual component within the circuit that is causing the trouble.

b. Question the vehicle operator to obtain the maximum number of observed symptoms. The greater the number of symptoms of trouble that can be evaluated, the easier will be the isolation of the primary cause or defect. Since the operator of the vehicle, in most instances, can describe malfunctions only in terms of unsatisfactory vehicle performance, trained personnel should be capable of analyzing the operational symptoms to determine the primary cause of the malfunction.

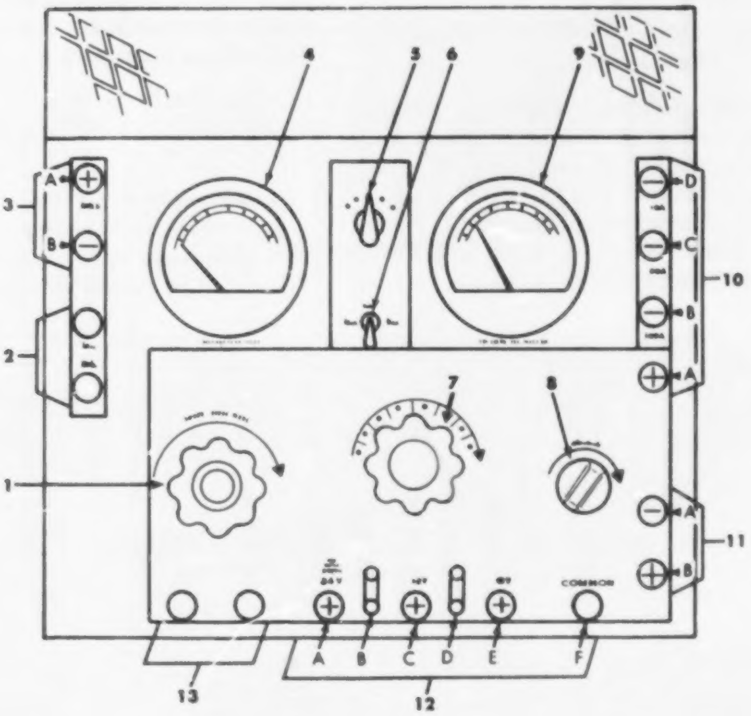
c. The functional system circuits covered in this manual are in the following sequence:

	Figure
1. Battery System Circuit	2–16
2. Starting System Circuit	2–17 to 2–22
3. Generating System Circuit ..	2–23 to 2–26
4. Lighting System Circuit	2–27 to 2–38


5
6
7
8
9
4
A
B
C
3
2
A
1
EXT. SHUNT
VOLTS
COARSE LOAD CONTROL
FINE LOAD CONTROL
FIELD RHEOSTAT
-10A
-50A
-100A
COMMON
24V
12V
FIELD RESISTOR
B
C
D
A
B
C
14
13
12
11
10
A
B
AT 12527

1—Ammeter binding posts
  A—10 amp negative
  B—50 amp negative
  C—100 amp negative
  D—Positive
2—Load bank link, 12 volt
3—External shunt binding posts
  A—Positive
  B—Negative
  C—Disconnect link
4—Ammeter
5—Load bank control, coarse
6—Load bank control, fine
7—Load bank switch
8—Voltmeter range selector switch
9—Voltmeter
10—Voltmeter binding posts
  A—Positive
  B—Negative
11—Field rheostat control
12—Field rheostat binding posts
13—1/4-ohm resistor binding posts
14—Load bank binding posts
  A—Common
  B—24 volts
  C—12 volts

Figure 2–4. Low voltage circuit tester Allen 30–32.



AT 12528

1—Field rheostat control
2—1/4-ohm resistor binding posts
3—Voltmeter binding posts
  A—Positive
  B—Negative
4—Voltmeter
5—Voltmeter range selector switch
6—Load bank switch
7—Load bank control, coarse
8—Load bank control, fine
9—Ammeter
10—Ammeter binding posts
  A—Positive
  B—100 amp negative
  C—50 amp negative
  D—10 amp negative
11—External shunt binding posts
  A—Negative
  B—Positive
12—Load bank binding posts
  A—24 volts
  B—12 volt link
  C—12 volts
  D—6 volt link
  E—6 volts
  F—Common
13—Field rheostat binding posts

Figure 2-5. Low voltage circuit tester RAM 62F151.

	Figure
5. Directional Signal System Circuit	2-34 to 2-38
6. Instruments, Gages and Horn System Circuit	2-39 to 2-46
7. Low Air Pressure Warning Buzzer and Manifold Heater System Circuits	2-48 to 2-50
8. Fuel System Circuit	2-47, 2-51 to 2-56
9. Trailer Connection and Van Connection System Circuits	2-57 and 2-58
10. Bilge Pump System Circuit	2-59 and 2-60
11. Expansible Van Body System Circuit	2-61 to 2-69

2-22. Test Equipment

a. Description.

(1) *Low voltage circuit tester.* Figures 2-2 through 2-5 illustrate some of the types of Low Voltage Circuit Testers (LVCT) in general use. The LVCT consists of a voltmeter, an ammeter, a fixed resistance, load bank, and field rheostat unit. They are mounted in a metal case, which also provides stowage space for the meter leads and accessories (fig. 2-6) used for making all the necessary tests. Other test sets are similar, and all tests described in

this section can be performed equally well with these testers. Figure 2–7 shows a schematic diagram of two typical testers, to better understand how the tester components function with the circuit being tested.

(2) *Multimeter.* The multimeter (fig. 2–8) is a lightweight portable instrument for use in making voltage tests where load banks or ammeter ranges are not required. The multimeter is also useful in making resistance or continuity tests of components suspected of being open, intermittent, or short-circuited.

b. Low Voltage Circuit Tester Functions and Use.

Note. The key numbers noted in parentheses are in figure 2–2, except where otherwise noted.

(1) *Voltmeter.* The two voltmeter binding posts (11), marked positive (+) and negative (−) are used for making voltage tests of batteries, generators or wiring circuits. Four meter ranges (1, 10, 20 and 50 volts) are available, selected by the voltmeter range selector switch (10).

(2) *Ammeter.* Four ammeter binding posts (2) are provided for making current readings up to 100 amperes. One terminal (A) is a common positive (+) terminal; the others (B, C, D) provide a selection of three negative ranges of 10, 50, or 100 amperes. Two binding posts (1) are provided for the connection of an external shunt assembly to extend the ammeter range to 500 amperes for the measurement of heavy currents.

(3) *Fixed 1/4-ohm resistance unit.* Two binding posts (7) provide a fixed 1/4-ohm resistance for use in charging circuit tests. Although the ammeter is used for these tests, the 1/4-ohm resistor has no internal connection to the ammeter.

(4) *Field rheostat unit.* Two binding posts (9) provide a changeable resistance for use in generator and charging circuit tests. There is no internal connection between the field rheostat unit and any other component of the tester.

(5) *Load bank.* Six binding posts (6) provide the proper load resistances to set up generator charging rate tests for various battery and generator voltages. The common binding post (6A) is connected internally to the

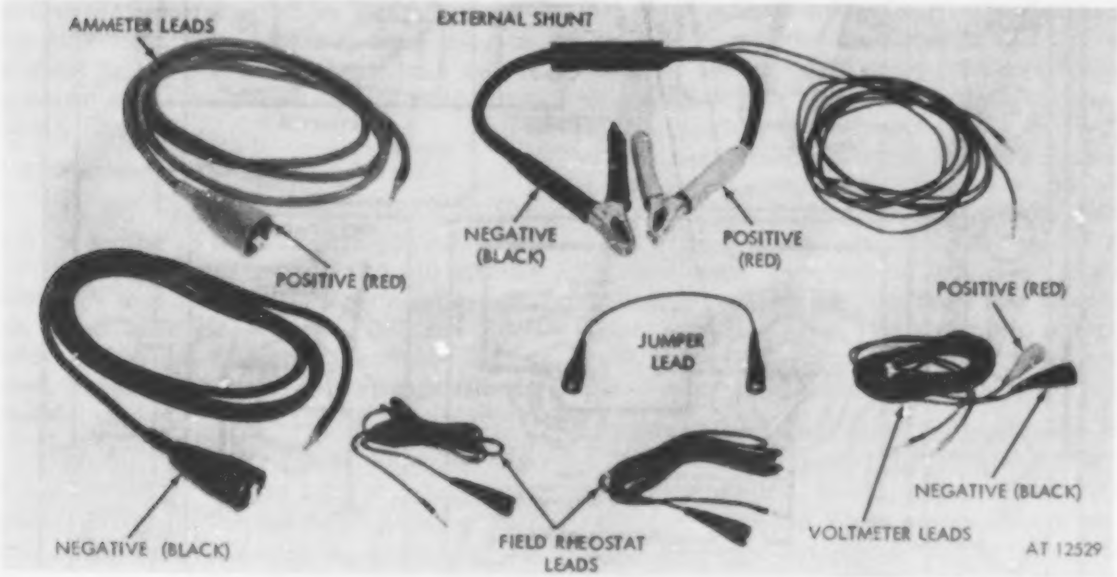
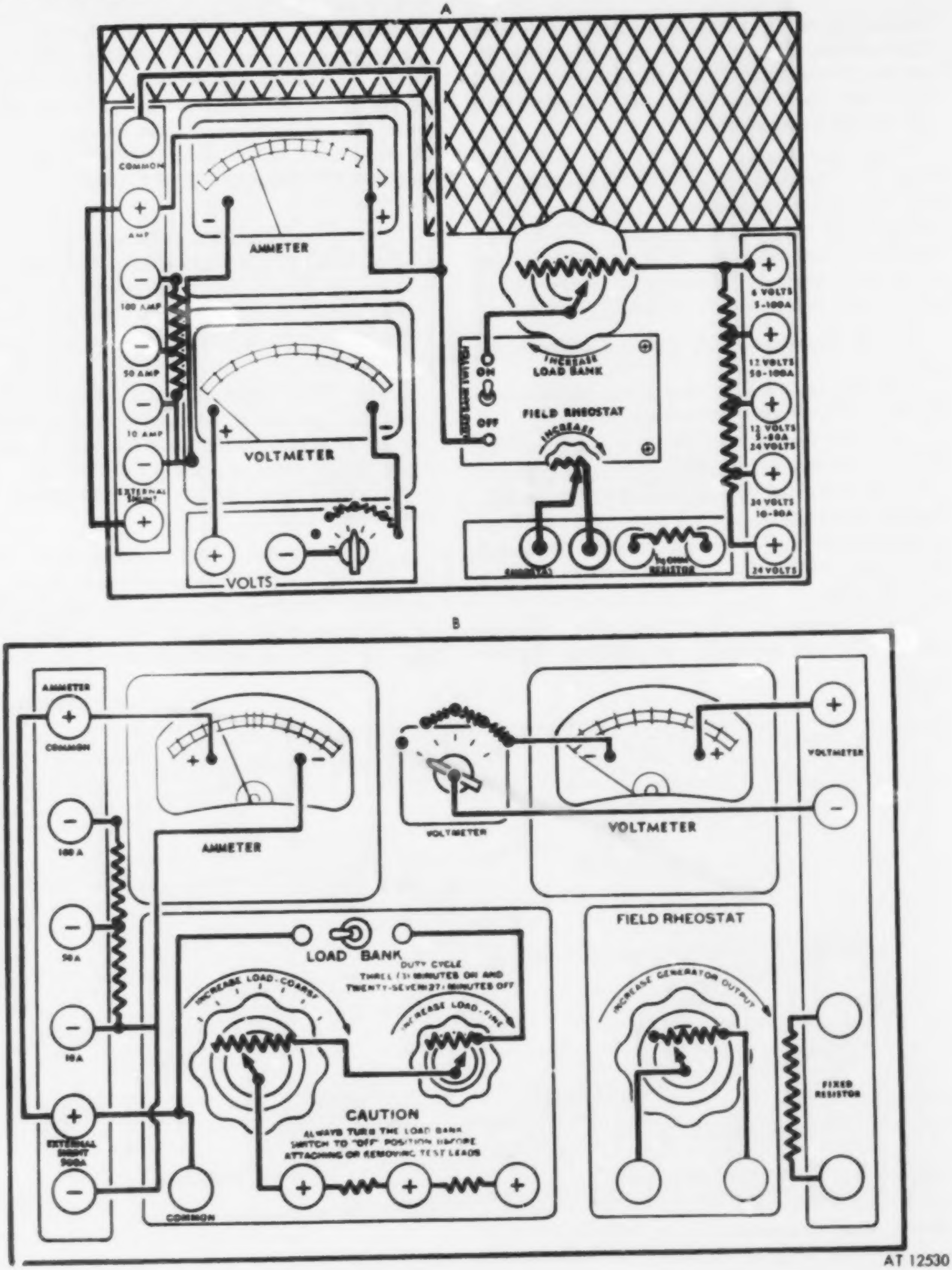
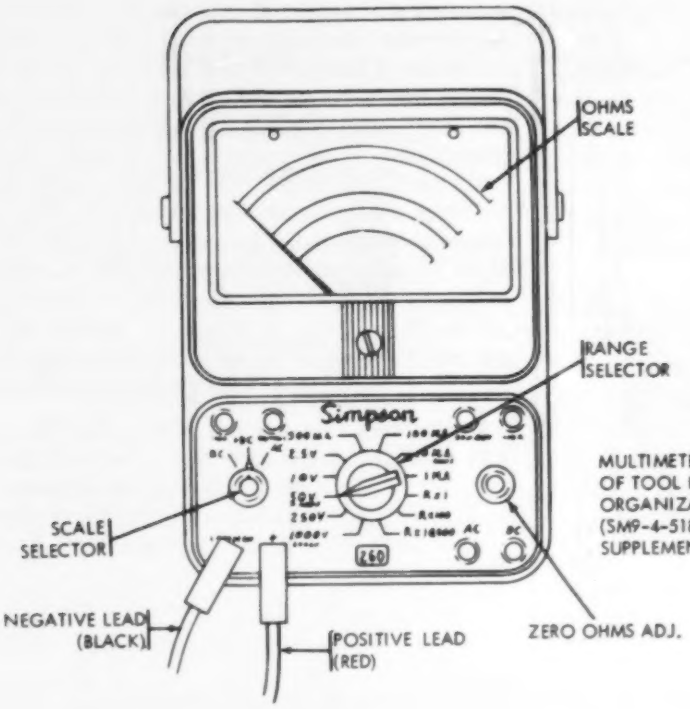


Figure 2–6. Test leads for use with low voltage circuit testers.


A
COMMON
AMP
100 AMP
50 AMP
10 AMP
EXTERNAL SHUNT
AMMETER
VOLTMETER
VOLTS
ON
OFF
INCREASE
LOAD BANK
FIELD RHEOSTAT
INCREASE
RESISTOR
6 VOLTS 5-100A
12 VOLTS 50-100A
12 VOLTS 5-80A 24 VOLTS
24 VOLTS 10-80A
24 VOLTS
B
AMMETER
COMMON
100 A
50A
10A
EXTERNAL SHUNT 500A
AMMETER
VOLTMETER
VOLTMETER
VOLTMETER
LOAD BANK
DUTY CYCLE THREE (3) MINUTES ON AND TWENTY-SEVEN (27) MINUTES OFF
INCREASE LOAD-COARSE
INCREASE LOAD-FINE
CAUTION
ALWAYS TURN THE LOAD BANK SWITCH TO "OFF" POSITION BEFORE ATTACHING OR REMOVING TEST LEADS
COMMON
FIELD RHEOSTAT
INCREASE GENERATOR OUTPUT
FIXED RESISTOR
AT 12530

A. Atomic Engineering Model TV-100 or Auto-Test, Inc. Model 10308B. B. Electro-Mechanisms Corp. Model 1060.

Figure 2-7. Schematic layout of low voltage circuit testers (typical).



MULTIMETER 6625-543-1438 IS A COMPONENT OF TOOL KITS, AUTOMOTIVE MAINTENANCE, ORGANIZATIONAL, SET NO. 1, SUPPLEMENTAL (SM9-4-5180-A17), AND SET NO. 2, SUPPLEMENTAL (SM9-4-4940-A08).

AT 12531

Figure 2-8. Multimeter—FSN 6625-543-1438.

ammeter positive (+) binding post (2A) eliminating the need for a jumper lead when making load tests. The load resistance may be changed by the load bank control knob (4) or removed from the circuit by the load bank switch (5).

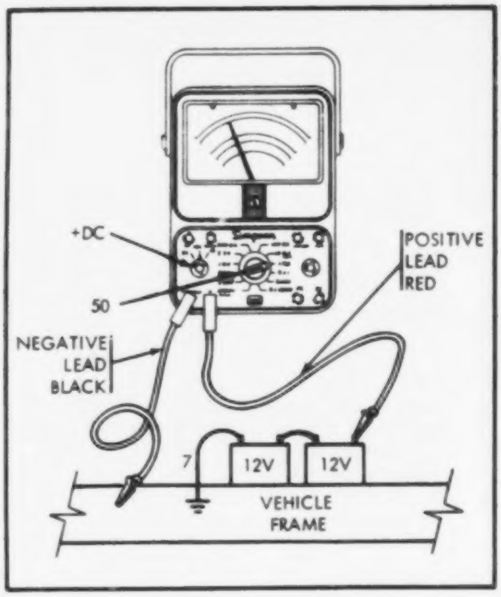
c. *Multimeter Functions and Use.*

(1) *DC voltmeter.* The voltmeter (fig. 2-9) is similar to the voltmeter portion of the LVCT. Three meter ranges (2.5, 10 and 50 volts) are available for use in automotive testing. Two additional ranges (250 and 1000 volts) are useful in testing electronic equipment. Ranges are selected by the range selector switch.

(2) *AC voltmeter.* The ac voltmeter (fig. 2-10) is used for making tests of lighting and power systems in the van body. Although several ranges are provided on the meter, only the 250-volt range is used for troubleshooting the van lighting and power systems.

(3) *Ohmmeter.* The ohmmeter (figs. 2-11 and 2-12) is used for making resistance and continuity tests. The ohmmeter is basically a voltmeter and internal battery connected in series, so that when the two test leads are connected together, the voltmeter reads the battery voltage. When a conductive circuit is connected between the test leads, the voltmeter will indicate how much voltage is being lost (voltage drop) in the circuit. In the case of a length of wire, there will be little or no drop; for a small coil or a resistor, there may be considerable voltage drop. The amount of voltage drop is directly related to the resistance (in ohms) of the component being tested.

(4) *Other scales.* Since the multimeter is a general purpose instrument intended primarily for electronic testing, other scales and ranges are provided. These ranges are not normally used for automotive vehicle electrical troubleshooting, and are beyond the scope of this manual.



DC VOLTAGE TEST

(USED TO MEASURE BATTERY VOLTAGE, VOLTAGE DROPS, OR DC VOLTAGE AT TEST POINTS.)

1. SET SCALE SELECTOR ON +DC.
2. SET RANGE SELECTOR ON 50V.
3. CONNECT NEGATIVE LEAD (BLACK) TO VEHICLE FRAME, ENGINE, OR OTHER NEGATIVE TEST POINT STATED IN TEST PROCEDURE.
4. TOUCH POSITIVE LEAD (RED) TO TEST POINT STATED IN TEST PROCEDURE. NEEDLE SHOULD MOVE TOWARD CENTER OF SCALE TO INDICATE VOLTAGE.

AT 12532

Figure 2-9. DC voltage test with multimeter.

2-23. General Instructions for Use of Test Sets and Multimeter

Caution: **Before proceeding with vehicle troubleshooting procedures, paragraphs 2-24 and 2-25 must be read and understood by all personnel using the test set. Incorrect connections to the test set could result in costly damage to test equipment or vehicle components.**

a. Be sure of the test to be made and the procedure to be used. Follow the step-by-step procedure given for each individual test.

b. Always select a meter range higher than the expected reading. Set the tester for this range before connecting it into the circuit.

c. Be sure to read the correct row of meter scale figures which correspond to the selected range. The range selector switch or the binding post marking always shows the right-hand figure of the row to be used. For example, if the range selector is set for 50 volts, read the row of meter scale figures that ends with 50 on the right-hand end.

d. When testing with an ammeter or ammeter shunt, always connect it in series with circuit to be tested. For maximum safety, the power should be turned off when connecting or disconnecting the ammeter or ammeter shunt.

e. When testing with a voltmeter, always connect it in parallel with (across) the terminals of the component to be tested. Where the terminals are easily accessible, the power need not be turned off to make voltage tests. Where there is a possibility of touching an adjacent terminal or the vehicle frame when attaching the position (red) test lead clip, the power should be off and the test lead clipped securely to the terminal to be tested before restoring power.

Caution: **Never attempt to make resistance tests until all sources of power connected to the circuit or device to be tested are disconnected. The multimeter will be damaged if this procedure is not followed.**

f. When testing with an ohmmeter, always connect it in parallel with (across) the terminals of the component to be tested. (If the component has only a single terminal, connect between the terminal and the metallic frame of the component.) In addition, the component being tested must be electrically free from the circuit. Remove all connections to the component before making any resistance or continuity tests. The component may remain mounted in the vehicle provided all other circuit connections have been removed. One terminal of most automotive electrical components is grounded to the vehicle. A negative ground wire is included in all cable runs. Most components are connected to this ground circuit.

g. Always handle the test sets carefully. Although the test set is ruggedly built, the meter movements are delicate mechanisms and can be damaged easily by rough handling. Be sure to stow all test leads and adapters in their proper compartments after the tests have been completed.

***Caution:* In choosing a location for the low voltage circuit tester, at the vehicle or on the service bench, be sure to place the tester in a position that will not restrict the air flow through the bottom and top openings. Do not exceed the duty cycle of 3 minutes "ON" and 27 minutes "OFF".**

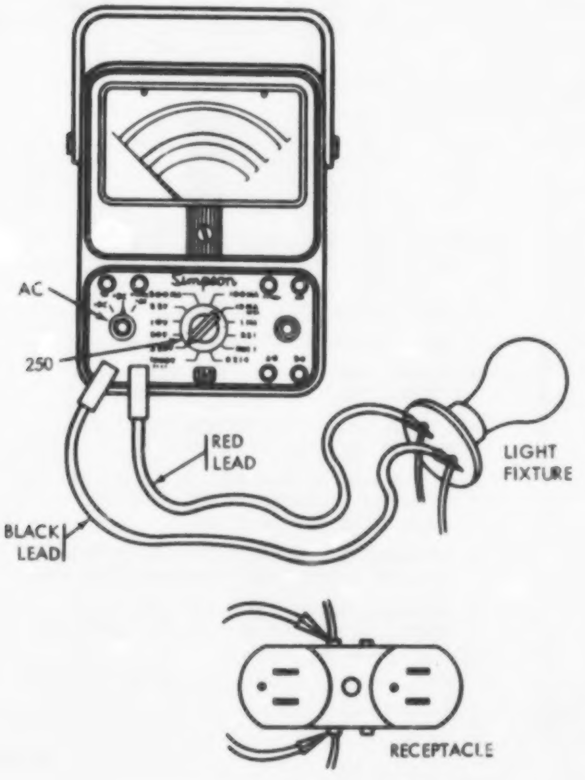
2-24. Specific Instructions for Use of the Lo Voltage Circuit Testers

Note. Complete detailed information on low voltage circuit testers is contained in TM 9-4910-401-12 and TM 9-4910-402-12.

Note. The key numbers noted in parentheses are in figure 2-2, except where otherwise noted.

a. DC Voltage Tests.

(1) Determine exactly what is to be



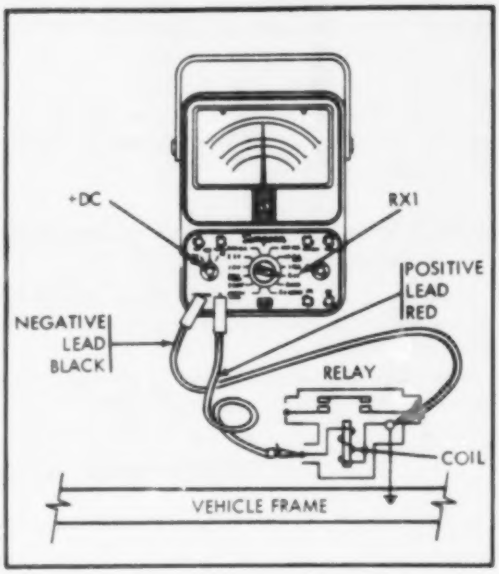
AC VOLTAGE TEST

(USED TO MEASURE AC VOLTAGE AT VARIOUS POINTS IN THE VAN BODY).

1. SET SCALE SELECTOR TO AC.
2. SET RANGE SELECTOR TO 250V.
3. WITH POWER TURNED OFF, CONNECT TEST CLIPS TO TERMINALS OF UNIT TO BE TESTED. EITHER COLOR TO EITHER TERMINAL.
4. TURN ON POWER. NEEDLE SHOULD MOVE TOWARD CENTER OF SCALE TO INDICATE VOLTAGE.
5. TURN OFF POWER BEFORE TOUCHING OR REMOVING CLIPS TO AVOID ELECTRICAL SHOCK.

AT 12533

Figure 2-10. AC voltage test with multimeter.



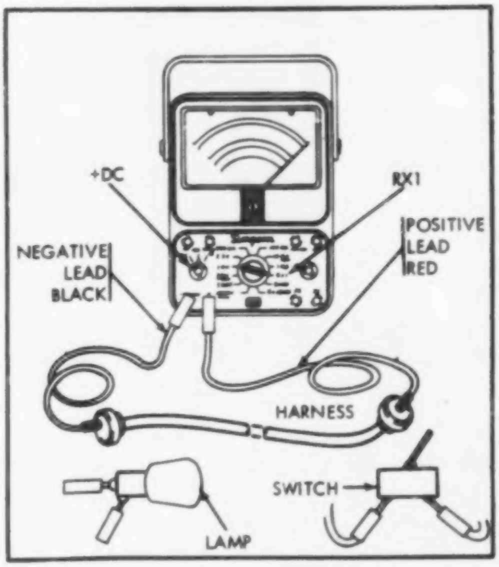
RESISTANCE TEST

(USED TO MEASURE RESISTANCE OF COILS OR RESISTORS, AND TO LOCATE SHORT CIRCUITS)

1. SET SCALE SELECTOR SWITCH ON +DC.
2. SET RANGE SELECTOR SWITCH ON Rx1.
3. TOUCH METER LEADS TOGETHER AND TURN ZERO OHMS ADJUST UNTIL NEEDLE IS ON "O" OHMS.
4. MAKE SURE THERE IS NO BATTERY VOLTAGE CONNECTED TO CIRCUIT TO BE TESTED.
5. ATTACH NEGATIVE LEAD (BLACK) TO COMPONENT FRAME, OR NEGATIVE TERMINAL.
6. TOUCH POSITIVE LEAD (RED) TO OTHER TERMINAL OF COMPONENT BEING TESTED.
7. READ RESISTANCE ON METER SCALE.
8. IF METER NEEDLE DOES NOT MOVE, CIRCUIT IS OPEN.
9. IF METER NEEDLE MOVES COMPLETELY ACROSS SCALE TO "O" A SHORT CIRCUIT EXISTS, OR A HEAVY-DUTY COMPONENT WITH VERY LOW RESISTANCE.

AT 12534

Figure 2-11. Resistance test with multimeter.



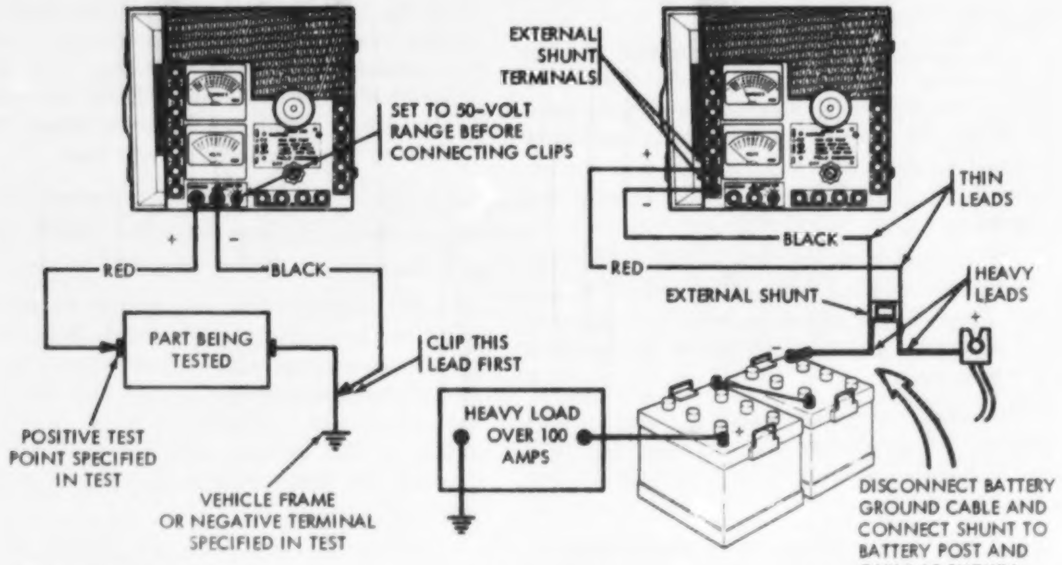
CONTINUITY TEST

(USED TO TEST FOR CABLE BREAKS, LOOSE WIRES, BURNT OUT LAMPS OR OTHER ITEMS)

1. SET SCALE SELECTOR ON +DC.
2. SET RANGE SELECTOR SWITCH ON Rx1.
3. BE SURE THERE IS NO BATTERY VOLTAGE CONNECTED TO CIRCUIT TO BE TESTED.
4. ATTACH NEGATIVE LEAD (BLACK) TO ONE END OF CIRCUIT.
5. TOUCH POSITIVE LEAD (RED) TO OTHER END OF CIRCUIT. NEEDLE SHOULD MOVE TO RIGHT HAND END OF SCALE.
6. IF NEEDLE DOESN'T MOVE, CIRCUIT IS OPEN, OR LAMP IS BURNT OUT, OR COMPONENT OPEN.
7. IF NEEDLE FLICKERS, OR JUMPS BACK AND FORTH, LOOSE CONNECTIONS ARE INDICATED.

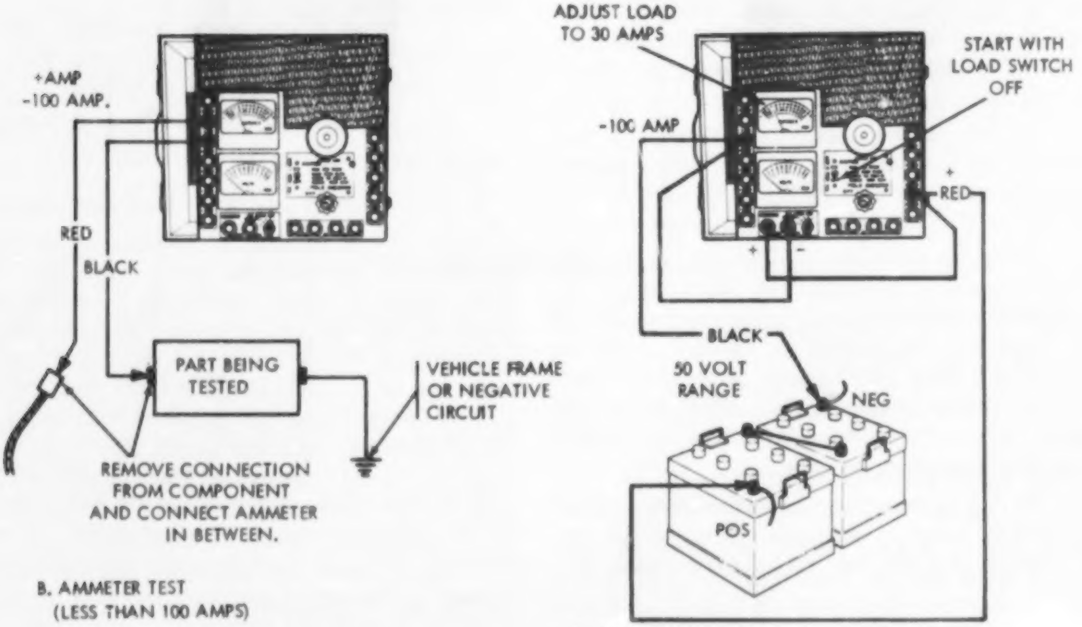
AT 12535

Figure 2-12. Continuity test with multimeter.


SET TO 50-VOLT
RANGE BEFORE
CONNECTING CLIPS
+
-
RED
BLACK
PART BEING
TESTED
CLIP THIS
LEAD FIRST
POSITIVE TEST
POINT SPECIFIED
IN TEST
VEHICLE FRAME
OR NEGATIVE TERMINAL
SPECIFIED IN TEST
EXTERNAL
SHUNT
TERMINALS
+
-
THIN
LEADS
BLACK
RED
HEAVY
LEADS
EXTERNAL SHUNT
+
HEAVY LOAD
OVER 100
AMPS
DISCONNECT BATTERY
GROUND CABLE AND
CONNECT SHUNT TO
BATTERY POST AND
CABLE AS SHOWN.

A. VOLTMETER TEST

C. AMMETER TEST WITH EXTERNAL SHUNT
(OVER 100 AMPS)


+AMP
-100 AMP.
RED
BLACK
PART BEING
TESTED
VEHICLE FRAME
OR NEGATIVE
CIRCUIT
REMOVE CONNECTION
FROM COMPONENT
AND CONNECT AMMETER
IN BETWEEN.
ADJUST LOAD
TO 30 AMPS
START WITH
LOAD SWITCH
OFF
-100 AMP
+
RED
+
-
BLACK
50 VOLT
RANGE
NEG
POS

B. AMMETER TEST
(LESS THAN 100 AMPS)

D. LOAD BANK TEST

AT 12536

Figure 2-18. Typical arrangements of tests with low voltage circuit tester TV-100.

tested, where the test leads will be connected, and what voltage to expect.

(2) Voltage must be measured at the exact circuit point specified in Electrical Troubleshooting tests. Resistance of poor wiring, connections, and switch contacts can cause errors if voltages are measured at points elsewhere in the circuit or on other parts of the component.

(3) Connect the voltmeter test leads (fig. 2-6) to the voltmeter binding posts (11, fig. 2-2). Connect the black lead to the negative (–) post (B), and the red lead to the positive (+) post (A).

(4) Set the voltage range selector switch (10) to a range higher than the expected voltage. Determine exactly which row of figures you will read.

***Caution:* (4) must be done before (5). A voltage range setting lower than the circuit voltage will damage the meter when (6) is performed.**

(5) Connect the negative (black) lead first to the circuit to be tested. This will usually be the negative ground terminal for cab and chassis components, or the engine frame for engine components (fig. 2-13).

(6) Touch the positive (red) lead to the other circuit connection. If the meter needle moves to the left, reverse the test leads at the circuit—not at the tester binding posts.

(7) Read the voltage carefully, facing the meter squarely. Viewing the meter from an angle will result in inaccurate readings.

b. DC Current Tests.

(1) Determine exactly what is to be tested, where the test leads will be connected, and what amperage to expect.

(2) Amperage may be measured at any convenient point in a single circuit, since the current is always the same throughout the circuit.

(3) Connect the ammeter red test lead (fig. 2-6) to the positive (+) binding post (2A, fig. 2-2). Tighten the binding post securely.

(4) Select a negative binding post (2B, C or D, fig. 2-2) marked with an amperage range higher than the expected amperage. Connect the ammeter black test lead (fig. 2-6) to this selected binding post and tighten the binding post securely. Determine exactly which row of figures on the ammeter you will read.

***Caution:* (4) must be done before (5). An amperage range lower than the circuit current will damage the meter when (6) is performed.**

(5) Be sure that no power is being applied to the circuit to be tested. Separate the circuit at a convenient junction point to form two connection points. Connect the red wire to the connection point which is electrically closer to the battery positive (+) terminal. Connect the black wire to the other connection point (fig. 2-13).

(6) Apply power to the circuit momentarily, observing the ammeter. The needle should move to the right. If the needle moves to the left, interchange the red and black wires at the circuit test points—not at the tester binding posts.

(7) Read the ammeter carefully, facing the meter squarely. Viewing the meter from an angle will result in inaccurate readings.

(8) Remove the power from the circuit before disconnecting the test leads.

c. DC Current Tests With Ammeter Shunt.

(1) When current exceeding 100 amperes is expected, the external shunt assembly (fig. 2-6) should be used. The shunt assembly consists essentially of a power resistor which passes 98% of the circuit current and allows only 2% to be sent to the meter. Thus, if the circuit current was 200 amperes, 196 amperes would pass through the shunt and 4 amperes would be sent to the meter. The 500-ampere figures on the meter scale are used for this shunt. A 200-ampere current through the shunt will indicate a reading of 200 on the meter scale, although a current of only 4 amperes is actually flowing through the meter.

(2) Disconnect the power to the circuit to be tested. Connect the small diameter shunt leads to the shunt binding posts of the tester

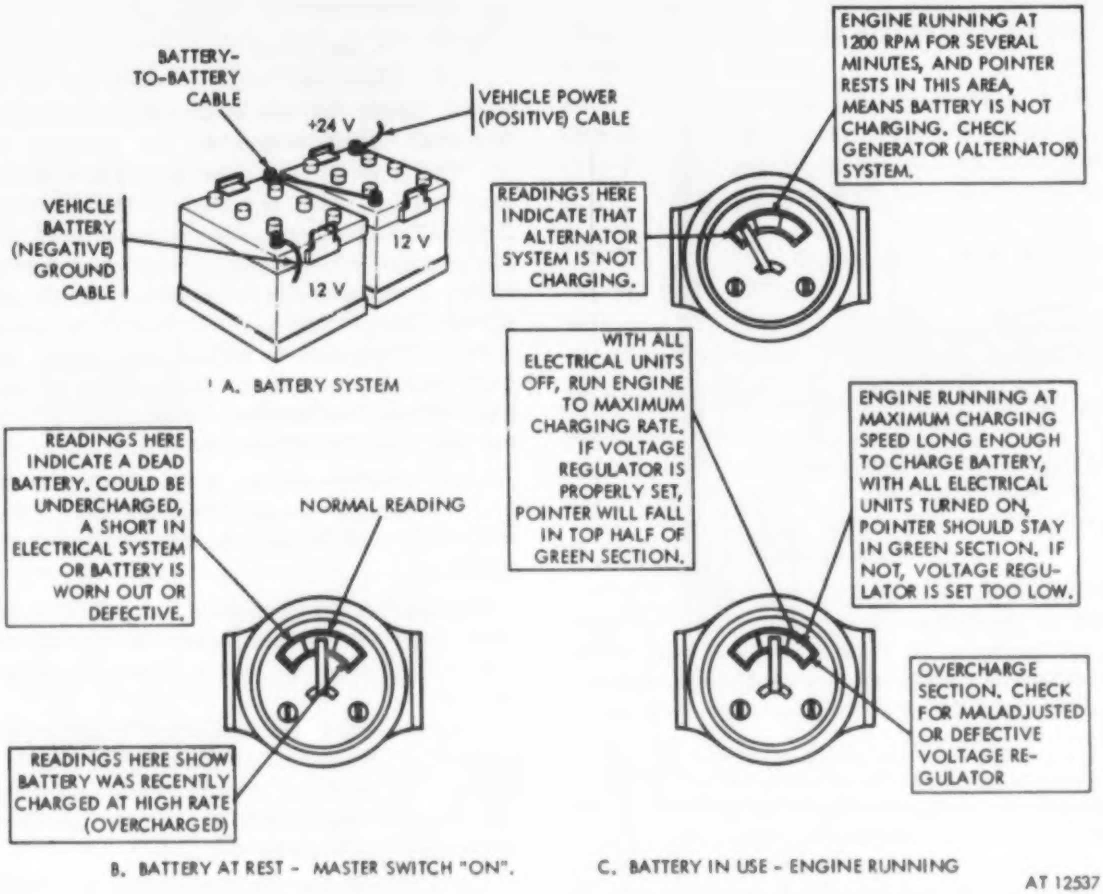

BATTERY-TO-BATTERY CABLE
+24 V
VEHICLE POWER (POSITIVE) CABLE
VEHICLE BATTERY (NEGATIVE) GROUND CABLE
12 V
12 V
A. BATTERY SYSTEM
ENGINE RUNNING AT 1200 RPM FOR SEVERAL MINUTES, AND POINTER RESTS IN THIS AREA, MEANS BATTERY IS NOT CHARGING. CHECK GENERATOR (ALTERNATOR) SYSTEM.
READINGS HERE INDICATE THAT ALTERNATOR SYSTEM IS NOT CHARGING.
READINGS HERE INDICATE A DEAD BATTERY. COULD BE UNDERCHARGED, A SHORT IN ELECTRICAL SYSTEM OR BATTERY IS WORN OUT OR DEFECTIVE.
NORMAL READING
READINGS HERE SHOW BATTERY WAS RECENTLY CHARGED AT HIGH RATE (OVERCHARGED)
WITH ALL ELECTRICAL UNITS OFF, RUN ENGINE TO MAXIMUM CHARGING RATE. IF VOLTAGE REGULATOR IS PROPERLY SET, POINTER WILL FALL IN TOP HALF OF GREEN SECTION.
ENGINE RUNNING AT MAXIMUM CHARGING SPEED LONG ENOUGH TO CHARGE BATTERY, WITH ALL ELECTRICAL UNITS TURNED ON, POINTER SHOULD STAY IN GREEN SECTION. IF NOT, VOLTAGE REGULATOR IS SET TOO LOW.
OVERCHARGE SECTION. CHECK FOR MALADJUSTED OR DEFECTIVE VOLTAGE REGULATOR
B. BATTERY AT REST - MASTER SWITCH "ON".
C. BATTERY IN USE - ENGINE RUNNING
AT 12537

Figure 2-14. Interpretation of battery-generator indicator gage.

(1, fig. 2-2); the red lead to the positive (+) binding post (B) and the black lead to the negative (−) binding post (A).

(3) Connect the heavy shunt leads to the circuit to be tested (fig. 2-13). Make sure all connections are tight.

(4) Follow all instructions given in *b*(5), (6), (7) and (8) above.

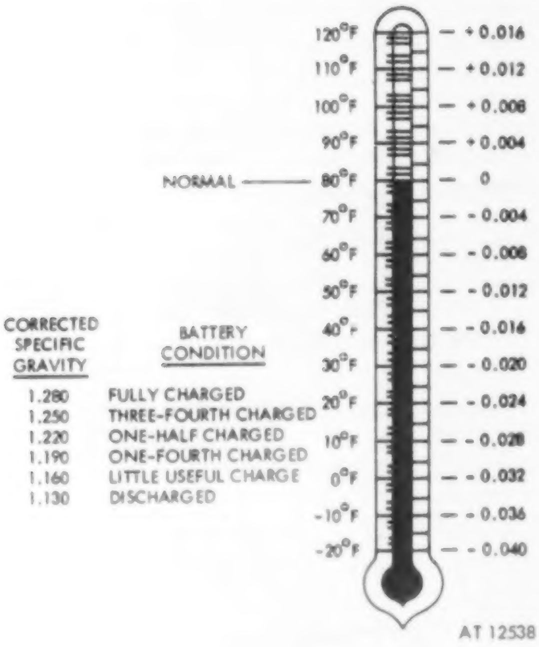
d. Load Bank and Field Resistance Tests.

(1) Three or more sections of the tester are used for these tests: the voltmeter, ammeter, and one or more of the resistances. Use extreme caution when connecting the test leads; severe damage can be caused to the tester and the components being tested if the test setup is incorrect. Follow the individual test setup illustration for the specific test being made. Figure 2-13 shows an example of a test of this type.

(2) Observe precautions in *a* and *b* above, for use of the voltmeter and ammeter.

(3) Both the LOAD BANK (4, fig. 2-2) and FIELD RHEOSTAT (8, fig. 2-2) knobs should be in the extreme counterclockwise position before connecting the load bank or field rheostat to the circuit being tested.

Note. The nameplates on the LOAD BANK and FIELD RHEOSTAT controls indicate clockwise rota-



CORRECTED SPECIFIC GRAVITY	BATTERY CONDITION
1.280	FULLY CHARGED
1.250	THREE-FOURTH CHARGED
1.220	ONE-HALF CHARGED
1.190	ONE-FOURTH CHARGED
1.160	LITTLE USEFUL CHARGE
1.130	DISCHARGED

Figure 2–15. Hydrometer temperature correction chart.

tion is required for an increase in current. However, to accomplish this effect, the actual resistance presented to the circuit is decreased with clockwise rotation of these controls. Refer to figure 2–7.

(4) Whenever resistances carry heavy currents, considerable heat is developed. To prevent heat damage to the resistors and other tester components, power should be applied to the resistors for not more than three minutes continuously. At least 27 minutes off time is required to allow the resistors to cool down sufficiently for another three-minute period of operation. Be sure there is sufficient ventilation provided for the tester. Before applying power to the circuit, have all connections in place and be ready to make the necessary adjustments and meter readings as rapidly as possible, consistent with accuracy and safety.

(5) Do not turn the LOAD BANK SWITCH (5, fig. 2–2) to OFF position while power is applied to the circuits. The switch contacts will arc and burn when subjected to heavy battery currents.

2–25. Specific Instructions for Use of the Multimeter

a. DC Voltage Tests.

(1) Determine exactly what is to be tested, where the test leads will be connected, and what voltage to expect.

(2) Voltage must be measurerd at the exact circuit point specified in the Electrical Troubleshooting tests. Resistance of poor wiring, connections, and switch contacts can cause errors if voltages are measured at points elsewhere in the circuit.

(3) Plug the voltmeter test leads (fig. 2–9) into the mulitimeter jacks. Plug the black lead into the jack marked "COMMON" and the red lead into the jack marked "+".

(4) Set the voltage range selector switch to a range higher than the expected voltage. Determine exactly which row of figures you will read.

Caution: **(4) must be done before (5). A voltage range setting lower than the circuit voltage will damage the meter when (6) is performed.**

(5) Connect the negative (black) lead first to the circuit to be tested. This will usually be the negative ground terminal for cab and chassis components, or the engine frame for engine components (fig. 2–9).

(6) Touch the positive (red) lead to the other circuit connection. If the meter needle moves to the left, reverse the test leads at the circuit—not at the multimeter jacks.

(7) Read the voltage carefully, facing the meter squarely. Viewing the meter from an angle will result in inaccurate readings.

b. AC Voltage Tests.

(1) Determine exactly what is to be tested, where the test leads will be connected, and what voltage to expect.

(2) Voltage is to be measured at the exact circuit points specified in the Electrical Troubleshooting tests. Resistance of poor wiring, connections, and switch contacts can cause errors if voltages are measured elsewhere in the circuit.

(3) Plug the voltmeter test leads (fig. 2-10) into the multimeter jacks. Plug the black lead into the jack marked "COMMON" and the red lead into the jack marked "+".

(4) Set the scale selector switch in the AC position. Set the range selector switch to 250 volts. Determine exactly which row of figures you will read.

(5) Be sure the component to be tested is clear of any metallic structural element of the van. If in close quarters, turn off the power switch or circuit breaker feeding the circuit, and clip the test leads carefully to the terminals to be tested. Dress the clips so they touch the terminals only, and do not touch each other, or any nearby metallic parts.

(6) Turn on the power, and read the voltage carefully, facing the meter squarely. Viewing the meter from an angle will result in inaccurate readings.

(7) Turn off the power before touching or removing the test lead clips.

c. *Resistance and Continuity Tests.*

Caution: **Never attempt to make resistance or continuity tests until all sources of power connected to the circuit or device to be tested are disconnected. The multimeter will be damaged if this procedure is not followed.**

All electrical circuits possess some resistance. Some resistances, however, are so small and others so large that they cannot be read on the same scale. When reading is obtained, it indicates the circuit has continuity (no break or openings). The following procedure must be followed to perform resistance or continuity tests:

(1) Place the SCALE SELECTOR switch (fig. 2-11) in the + DC position.

(2) Rotate the range selector switch to the required range to (1) R x 1 to measure resistance between 0 and 2,000 ohms and to test for continuity, (2) R x 100 to measure resistance between 0 and 200,000 ohms, and (3) R x 10,000 to measure resistance between 0 and 20 megohms (megohms = million ohms).

(3) Plug the black lead into the jack marked "COMMON" and the red lead into the jack marked "+". Touch the ends of the leads together and turn the ZERO OHMS knob until the pointer is at zero.

(4) Separate the ends of the test leads, and clip the leads across the portion of the circuit or component being tested (figs. 2-11 and 2-12). (Either of the leads may be clipped to the test points.)

(5) Read the ohms on the black area at the top of the scale.

Note. For range R x 1, read the figures directly; for range R x 100, multiply the reading indicated by 100 or add two zeros to the reading; for range R x 10,000 multiply the reading indicated by 10,000 or add four zeroes to the reading.

Example: A 20,000-ohm resistance should be checked on the R x 100 range scale. The reading on the scale will be 200. Adding two zeros will give 20,000 ohms.

(6) An infinite reading is an open circuit reading. There will be no movement of the multimeter pointer on the R x 1 when an open circuit exists. This usually indicates a broken connection somewhere. Infinite position on the ohmmeter range scale is marked with the symbol oo.

(7) A zero reading indicates a continuous circuit with resistance too low to be measured with the multimeter. Where two cable wires, or a circuit wire and a ground connection are being checked, this usually indicates a short circuit somewhere.

2-26. Preliminary Checks Prior to Troubleshooting

a. *Preliminary Battery Check.* The vehicle battery condition should be checked prior to performing any electrical checks in the vehicle. The vehicle has two 12-volt batteries connected in series, furnishing 24 volts to the electrical system (fig. 2-14) which uses a negative (−) ground and a positive (+) power feed to the electrical components. The negative ground is connected directly to the engine frame. To test the battery condition, turn the master switch to ON (without starting the engine). Observe the battery indicator (fig. 2-14). Start the engine, accelerate to about 1200 rpm, and again observe the battery indicator. If the indicator observations show that further tests are required, refer to the Electrical Troubleshooting tests, Battery System (fig. 2-16).

b. Specific Gravity Check. A specific gravity check should be made with a hydrometer as a routine check before making further tests. Observe the following precautions when making this check:

(1) Hold the hydrometer vertically, so the float does not touch the sides of the glass barrel. Be certain that the barrel is not so full of electrolyte that the float is stopped at the top. Read straight across the top of the liquid; disregard the curvature of the liquid at the edge of the glass and float.

(2) The electrolyte in a cell should be at the normal level when the reading is taken.

(3) When water is added, it will tend to remain at the top of the cell and a hydrometer reading will be inaccurate. If it is necessary to add water to the battery before taking a reading, the battery should be charged for 1 or 2 hours to mix the electrolyte before the hydrometer is used. This may be done by connecting the battery to a charger or by operating the vehicle.

(4) Gravity readings may also be misleading if taken immediately after a battery has been discharged at a high rate, such as in prolonged cranking. Wait several hours before taking a specific gravity reading.

(5) When the temperature of the electrolyte is much greater or much less than 80° F., the specific gravity indication on the hydrometer will not be accurate. A temperature correction must be applied to the reading to obtain the correct specific gravity. Figure 2-15 shows the amount of temperature correction to be applied, and how to estimate the condition of the battery from the temperature-corrected specific gravity.

Table 2-5. Troubleshooting the Electrical System

BATTERY SYSTEM CIRCUIT (Figure 2-16)

DESCRIPTION: Two 12-volt batteries are connected in series to provide 24 volts for the operation of all electrical equipment on the vehicle. The negative terminal of one battery is connected via circuit 7 to the chassis frame, the engine cylinder block, and the starting motor. All cab-mounted electrical components are connected to extensions of circuit 7 (circuits 57, 79, 91, 92, etc.) to provide a negative ground return to the battery. The positive battery terminal is connected via circuit 6 to the starter, then through circuit 5 to the alternator. Circuit 14C connects the positive battery voltage to the starter relay. Circuit 6 also connects the positive battery terminal to circuit 450 for distribution to other electrical systems on the vehicle. See figure 2-18.

The batteries and cables are waterproofed.

Malfunction	Circuit	Test
Vehicle will not crank. All electrical systems inoperative or weak.	6, 7, 68	Test 1. Make a visual inspection. Look for broken, cracked, or distorted battery cases. Check for loose terminals. Check for corrosion on the battery terminals, cables, battery holddown and around battery posts. Check the cables for frayed or worn insulation. Check the electrolyte level in each cell. If the level is below the plates, the battery may be permanently damaged. Also look for dirt, oil or other contaminants floating in the electrolyte. Perform all required clean-up and make necessary repairs before proceeding with further tests. Replace any damaged battery. Test 2. Check each cell for specific gravity of battery electrolyte with hydrometer. (Refer to para 2-26.) Batteries must test 1.225, or greater, temperature

Table 2-5. Troubleshooting the Electrical System—Continued

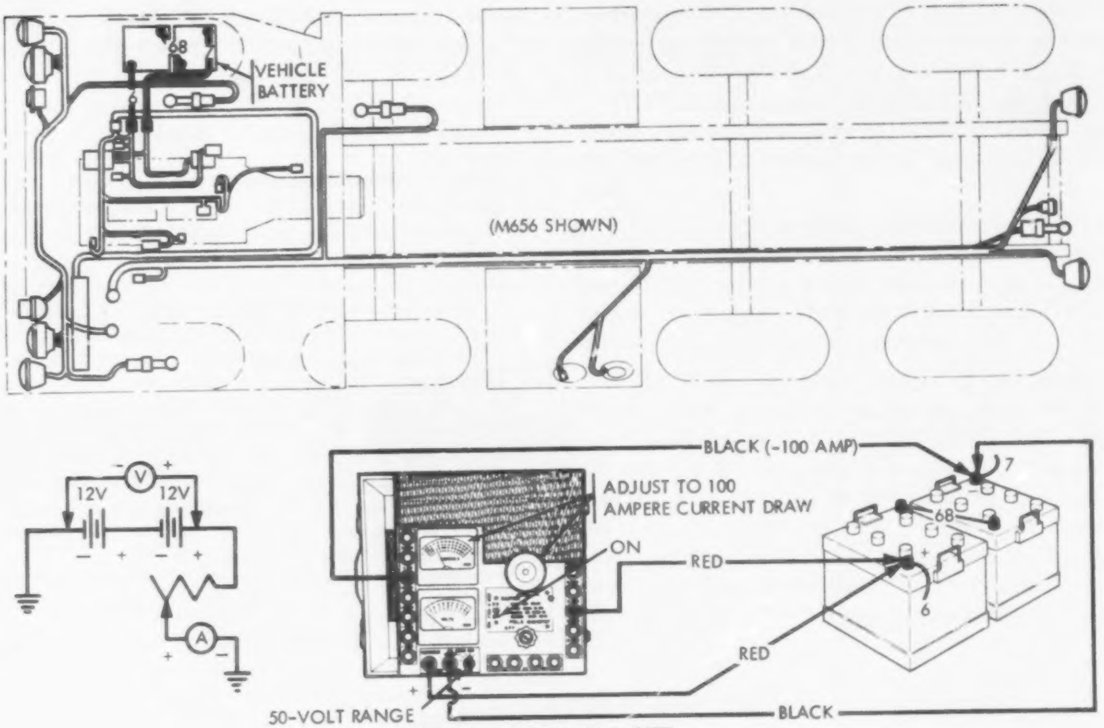
BATTERY SYSTEM CIRCUIT—Continued (Figure 2-16)

Malfunction	Circuit	Test
		corrected, and each cell must test within 25 gravity points of the others. If variation is more than 25 points, charge batteries fully, and recheck specific gravity on all cells. If 25-point variation still exists, one or both batteries are defective.
Slow cranking.	6, 7, 68	Test 3. Test batteries under load to determine their ability to crank engine under starting conditions, and to determine maximum voltage drop with a 100-ampere load for 15 seconds. Turn load bank switch "OFF" and rotate load bank control completely counterclockwise. Set voltmeter range selector switch to 50 volts. Connect circuit tester to batteries as shown in figure 2-16, test 3. Turn load bank switch "ON" and rotate load bank knob clockwise, watching ammeter scale until 100 amperes is indicated. Voltmeter should read not less than 18 volts during test, and 24 to 26 volts before and after test. If less, perform tests 4 and 5 to test individual batteries. *Note.* Tests 4 and 5 use the same circuit tester setup as test 3, except that the voltmeter leads are moved to test the voltage of each individual battery. Test 4. Test individual batteries to determine maximum voltage drop with a 100-ampere load for 15 seconds, or if each has a maximum variation of ± 2 volts of the other. Turn load bank switch "OFF" and rotate load bank control completely counterclockwise. Set voltmeter range selector switch to 20 volts. Connect circuit tester to batteries as shown in figure 2-16, test 4. Turn load bank switch "ON" and rotate load bank knob clockwise, watching ammeter scale until 100 amperes is indicated. Voltmeter should indicate 9 volts or more. If less than 9 volts, battery is discharged or defective. Charge battery and retest. Test 5. Same as test 4, on the other battery. Voltage should not fall below 9 volts, or be more than 2 volts higher or lower than the other battery.

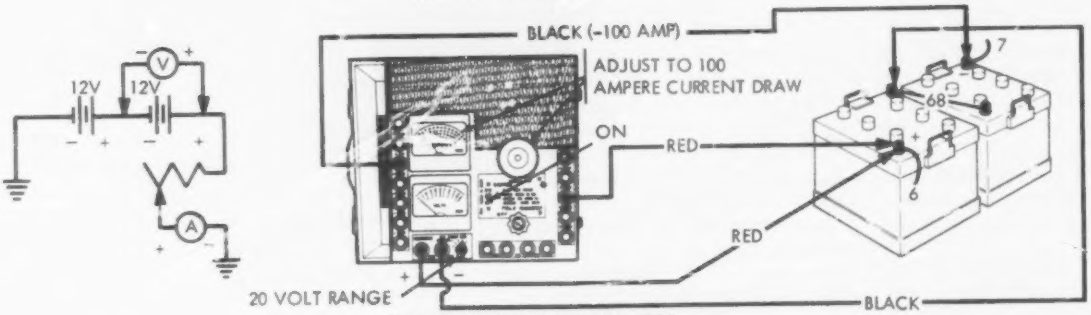
STARTING SYSTEM CIRCUIT (Figure 2-17)

DESCRIPTION: The starting system is divided into three individual circuits, interconnected by relays. When the master switch is in "START" position, the circuits are automatically energized in sequence, starting with the first circuit, which energizes the second circuit, which immediately energizes the third circuit. The first circuit includes the master switch, neutral safety switch and the coil of the starter relay (mounted on the vehicle frame). The second circuit includes the contacts of the starter relay and the coil of the starting motor solenoid (mounted on the starting motor). The third circuit includes the contacts of the starting motor solenoid, the starting motor, the battery, and the heavy cables interconnecting them. Figure 2-17 shows a basic diagram of the three systems.

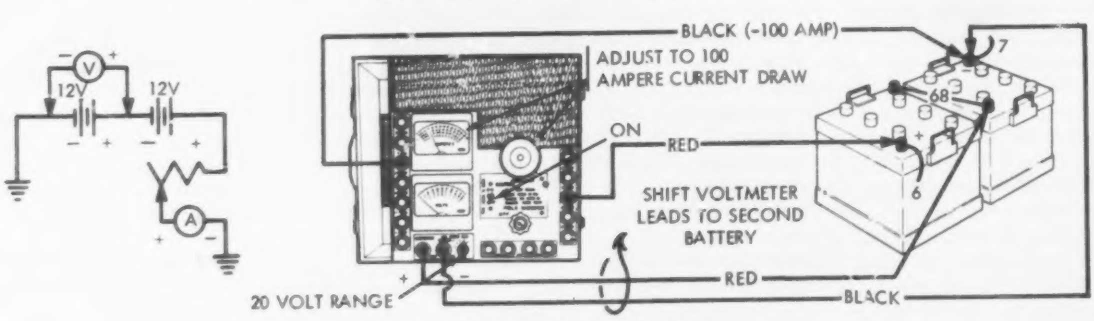
The circuits are energized as follows: Battery voltage is supplied via circuits 6, 450, 10 and 11 to the master switch. When the master switch is operated into the "START" position, current flows through the neutral safety switch (which must be closed by placing the transmission selector in neutral position) via circuit 14A through the starter relay coil then through circuit 7 to the negative battery terminal. This action


68
VEHICLE BATTERY
(M656 SHOWN)
12V
12V
V
A
BLACK (-100 AMP)
7
ADJUST TO 100 AMPERE CURRENT DRAW
68
ON
RED
6
RED
50-VOLT RANGE
BLACK

TEST 3. BATTERY LOAD TEST


12V
12V
V
A
BLACK (-100 AMP)
7
ADJUST TO 100 AMPERE CURRENT DRAW
68
ON
RED
6
RED
20 VOLT RANGE
BLACK

TEST 4. INDIVIDUAL BATTERY TEST


12V
12V
V
A
BLACK (-100 AMP)
7
ADJUST TO 100 AMPERE CURRENT DRAW
68
ON
RED
6
SHIFT VOLTMETER LEADS TO SECOND BATTERY
RED
20 VOLT RANGE
BLACK

TEST 5. INDIVIDUAL BATTERY TEST (COMPANION)

AT 12539

Figure 2-16. Battery system tests.

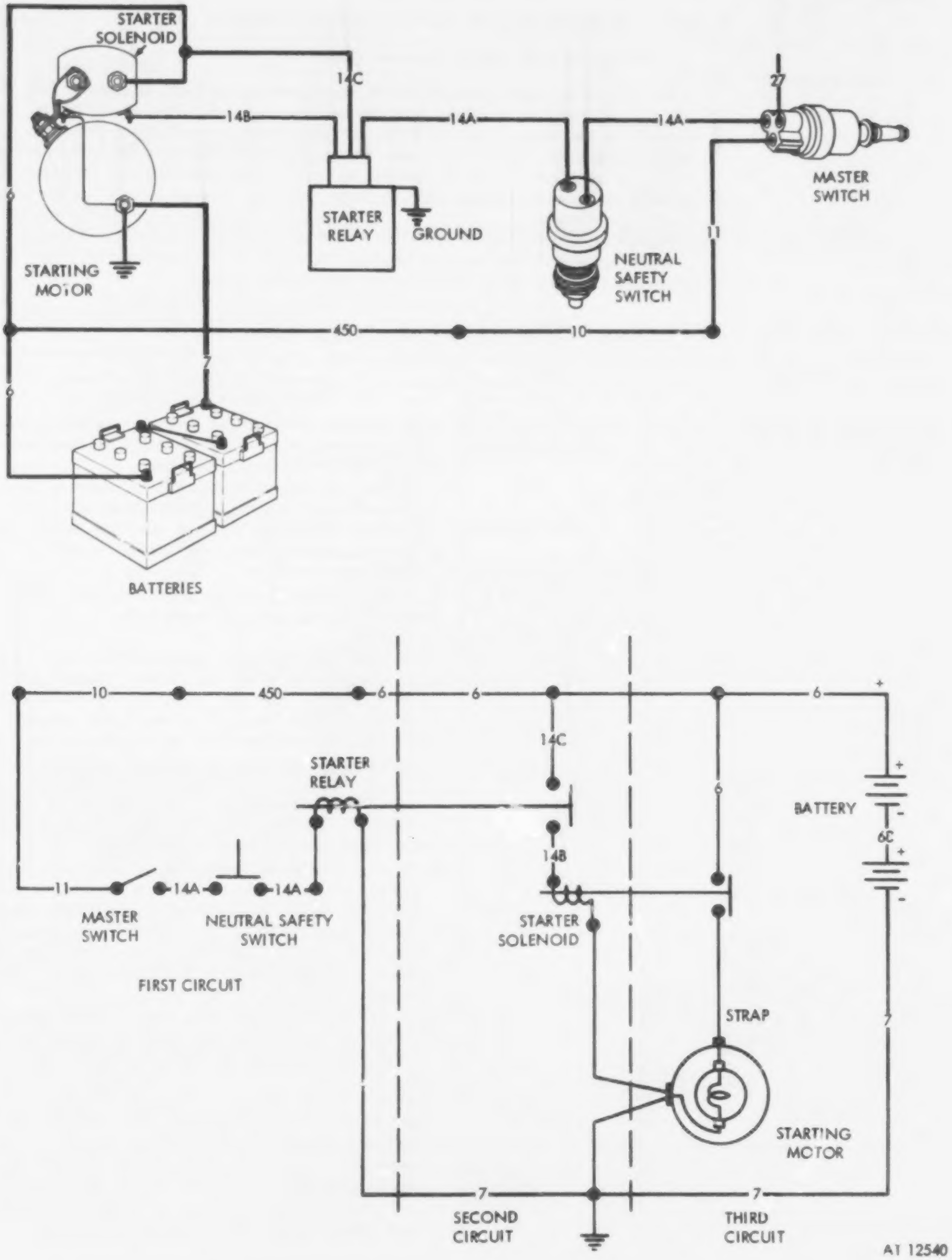

STARTER SOLENOID
14C
14B
14A
14A
27
MASTER SWITCH
STARTER RELAY
GROUND
NEUTRAL SAFETY SWITCH
11
STARTING MOTOR
6
450
10
7
6
BATTERIES
10
450
6
6
6
+
14C
STARTER RELAY
6
BATTERY
+
-
6C
+
-
14B
11
14A
14A
MASTER SWITCH
NEUTRAL SAFETY SWITCH
STARTER SOLENOID
FIRST CIRCUIT
STRAP
7
STARTING MOTOR
7
7
SECOND CIRCUIT
THIRD CIRCUIT
AT 12540

Figure 2-17. Engine starting system, basic circuits.

Table 2-5. Troubleshooting the Electrical System—Continued

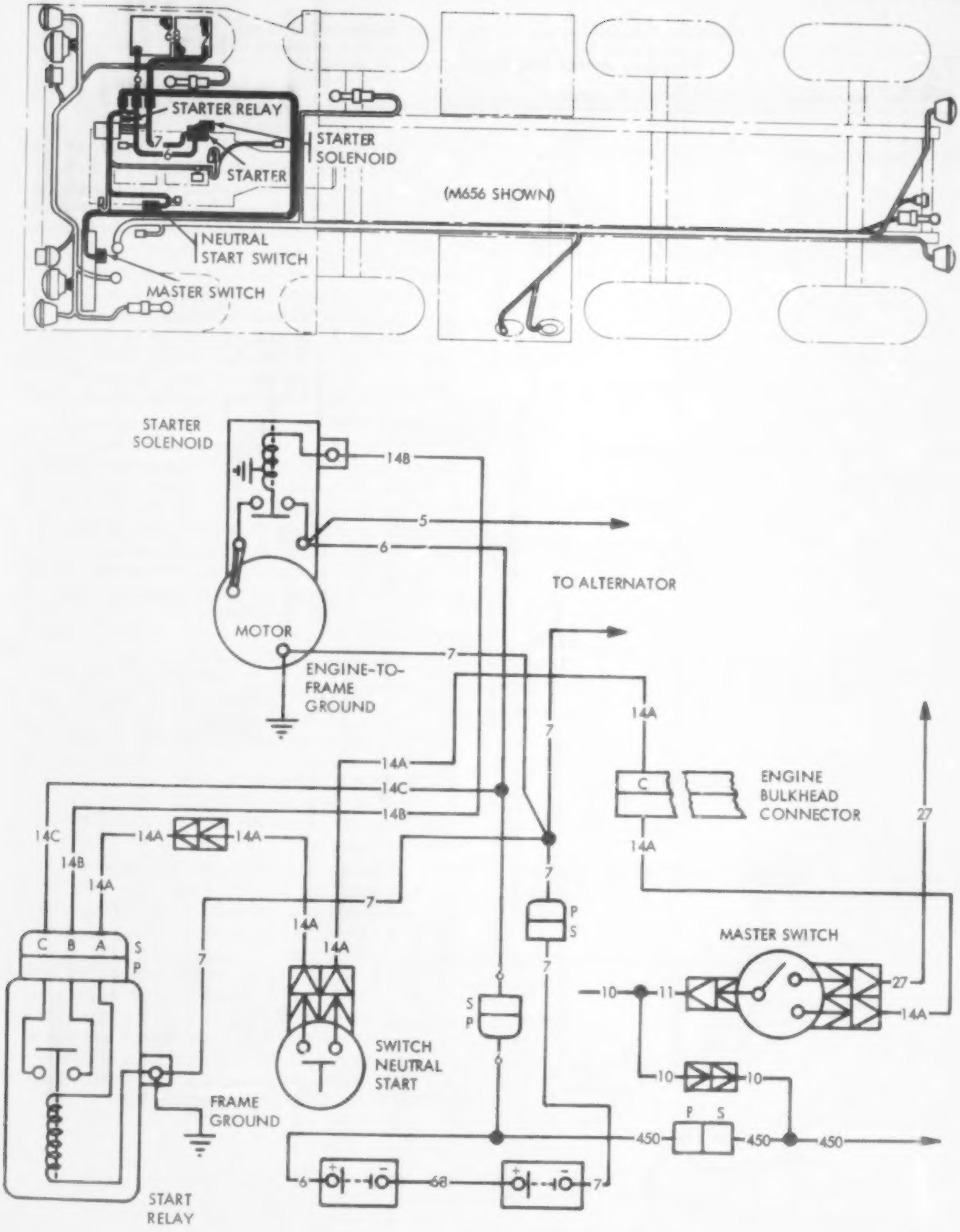
STARTING SYSTEM CIRCUIT—Continued (Figure 2-17)

closes the starter relay contacts, which causes current to flow via circuits 14C and 14B through the starting motor solenoid coil, then through a ground jumper wire to circuit 7 to the negative battery terminal. This energizes the starting motor solenoid which engages the starter clutch assembly and closes the heavy circuit to the starting motor. Current flows from the positive battery terminal via circuit 6, through the solenoid contacts, through the starting motor, and then through circuit 7 to the negative battery terminal.

Failure in any one of these three circuits will affect the operation of the starting motor and will prevent the engine from starting. The troubleshooting tests that follow will be divided into three parts, each covering one of these circuits.

STARTING SYSTEM CIRCUIT—Continued (Figure 2-18)

Malfunction	Circuit	Test
Starter fails to crank, or cranks slowly.	6, 7, 10, 11, 14A, 14B, 14C, 68, 450	PRELIMINARY CHECKS If the starting motor chanks slowly, or not at all, make the following quick checks to assist in locating the particular circuit that is defective. 1. Turn on the master switch. Check to see if the instruments are energized, particularly the battery-generator indicator. If they are not functioning, check the battery system or master switch for defects. 2. If the instruments are energized normally, check the condition of the batteries (para 2-26), and service as required. 3. When the batteries are in good condition, try to start the engine. Listen for the heavy "thump" of the starting motor solenoid (mounted on the starting motor). If this "thump" is heard, the solenoid is functioning normally. Look for trouble in the third circuit (starting motor and connecting cables) (tests 6 to 13). Because of the heavy currents needed to operate the starting motor, a great number of starter system failures can be traced to faulty cable and battery terminal connections in this circuit. 4. If no "thump" is heard, try to start the engine again, and listen for a "click" in the starter relay (mounted on the vehicle frame). If a "click" in the starter relay (mounted on the vehicle frame). If a "click" is heard in this relay, it is functioning normally. Look for trouble in the second circuit (starting motor solenoid) (tests 4 and 5). 5. If no "click" is heard at the starter relay, look for trouble in the first circuit (master switch, neutral switch, starter relay coil and connector) (tests 1 to 3). 6. Make a visual inspection. Examine the starter relay and starting motor terminal studs, the battery terminals and cables, to be certain that no loose or dirty electrical connections exist. After attempting to crank with the starter, feel all the battery clamps and starter relay terminals. A sensation of heat at any of these points indicates a poor connection.


STARTER RELAY
STARTER SOLENOID
STARTER
7
6
(M656 SHOWN)
NEUTRAL START SWITCH
MASTER SWITCH
STARTER SOLENOID
14B
5
6
TO ALTERNATOR
MOTOR
7
ENGINE-TO-FRAME GROUND
14A
14C
14B
14A
14A
7
C
ENGINE BULKHEAD CONNECTOR
27
14C
14B
14A
C B A
S P
P S
MASTER SWITCH
10
11
27
14A
14A
14A
SWITCH NEUTRAL START
S P
FRAME GROUND
10
10
P S
450
450
450
START RELAY
6
68
7

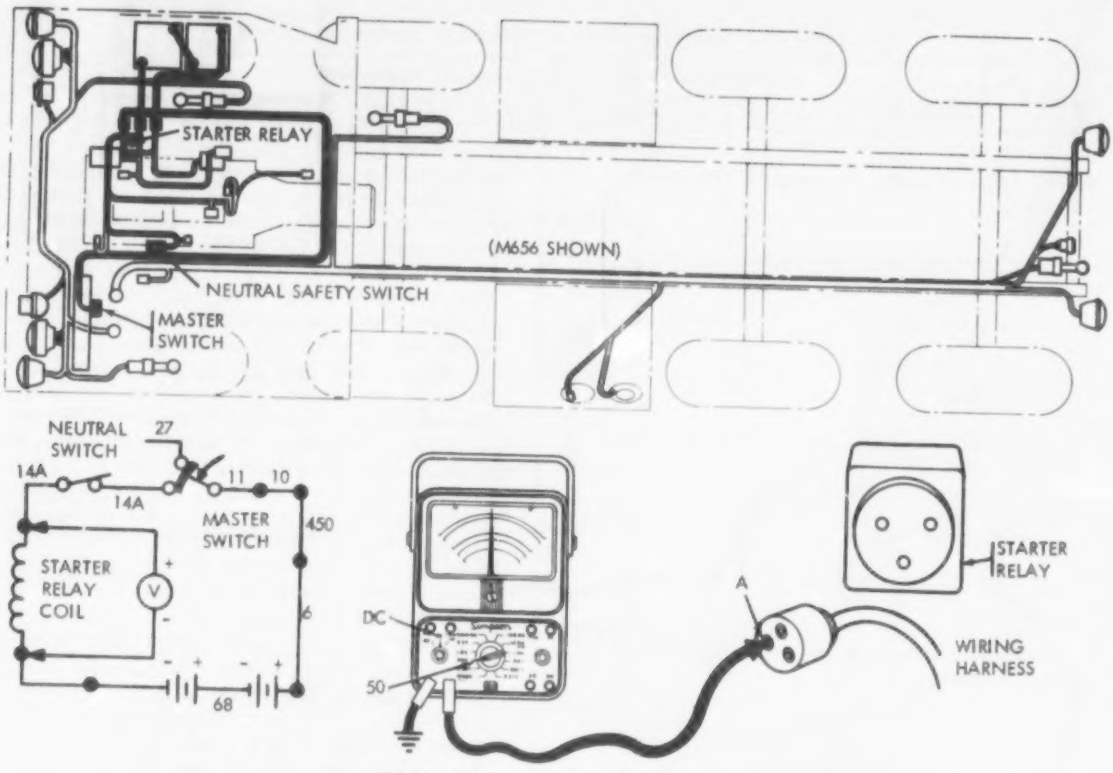
AT 12541

Figure 2-18. Engine starting and battery circuits, wiring diagram (30-60 alternator).

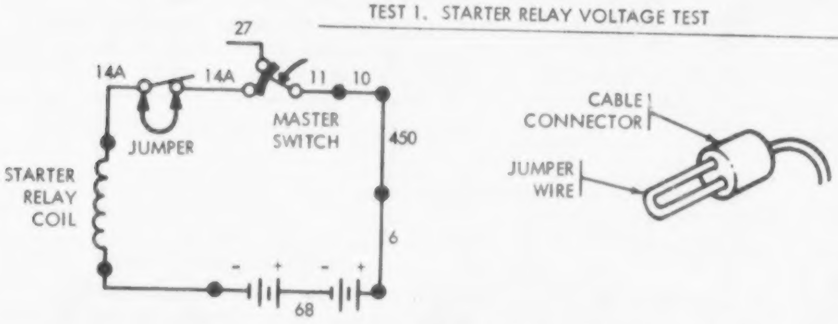
Table 2-5. Troubleshooting the Electrical System—Continued

STARTING SYSTEM CIRCUIT—Continued (Figure 2-19)

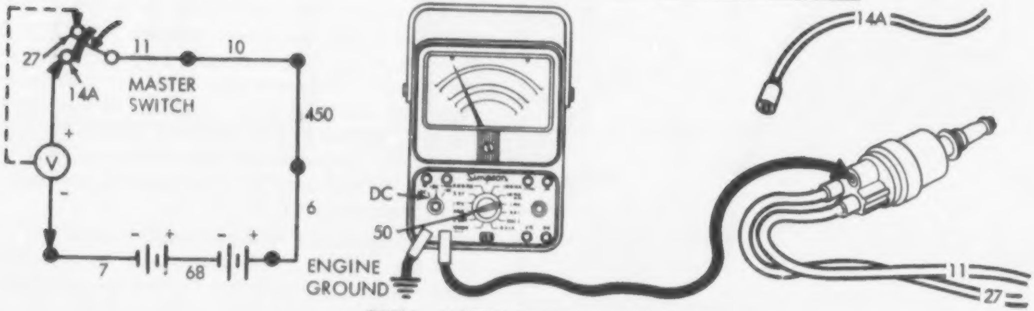
Malfunction	Circuit	Test
		FIRST CIRCUIT TESTS
Starter fails to crank.	14A, 7	Test 1. Perform the starter relay coil voltage test. Set up the multimeter for dc voltage tests (fig. 2-9). Remove the connector from the starter relay, mounted on the vehicle frame under the alternator. Connect the red test lead to socket "A" on the harness connector, and the black test lead to the vehicle frame as shown in figure 2-19, test 1. Place the master switch in "START" position. If the voltmeter indicates 24 volts, the wiring harness is satisfactory. Check the connector on the harness, and on the relay, for corroded or loose pin connections. If the connectors are clean, the relay is defective. Replace starter relay. If the voltmeter reads less than 24 volts on the connector, perform test 2.
Starter relay does not function.	14A, 7	Test 2. Perform the neutral safety switch test. Remove the connector from the neutral safety switch. Install a jumper between the two sockets in the cable connector as shown in figure 2-19, test 2. Move engine fuel cutoff switch to far right and hold it there. Move master switch to "START position. If the starter relay now operates (as evidenced by a sharp "click") or if the starting motor now cranks, the neutral safety switch is defective. If the starter relay does not "click" with the jumper installed, remove the jumper. Set up the multimeter for dc voltage tests (fig. 2-9). Have an assistant hold the master switch in "START" position, and measure the voltage at both sockets in the cable connector. One of these cable connectors should indicate 24 volts. If no or low voltage is measured on either socket, go to test 3. If voltage is measured on either socket, go to test 3. If voltage is measured on one socket, check the cable from the neutral switch to the starter relay for breaks or damage.
	6, 450, 10, 11, 14A, 7	Test 3. Perform the master switch voltage test. Set up the multimeter for dc voltage tests (fig. 2-9). Place the master switch in "RUN" position. If the instruments function normally on the instrument panel, remove wire 14A from the master switch and measure the voltage at the master switch terminal as shown in figure 2-19, test 3. Move the master switch to "START" position. If 24 volts is not measured at the master switch terminal 14A, the master switch is defective. However, if the instruments do not function with the master switch in "RUN" position, inspect circuits 11, 10, 450 and 6 to the battery.


STARTER RELAY
(M656 SHOWN)
NEUTRAL SAFETY SWITCH
MASTER SWITCH
NEUTRAL SWITCH
27
14A
14A
11
10
MASTER SWITCH
450
STARTER RELAY COIL
V
+
-
6
68
DC
50
A
STARTER RELAY
WIRING HARNESS

TEST 1. STARTER RELAY VOLTAGE TEST


27
14A
14A
11
10
JUMPER
MASTER SWITCH
450
STARTER RELAY COIL
6
68
CABLE CONNECTOR
JUMPER WIRE

TEST 2. NEUTRAL SAFETY SWITCH VOLTAGE TEST


27
14A
11
10
MASTER SWITCH
450
V
+
-
6
7
68
DC
50
ENGINE GROUND
14A
11
27

TEST 3. MASTER SWITCH VOLTAGE TEST

AT 12542

Figure 2-19. Starting system tests, first circuit.

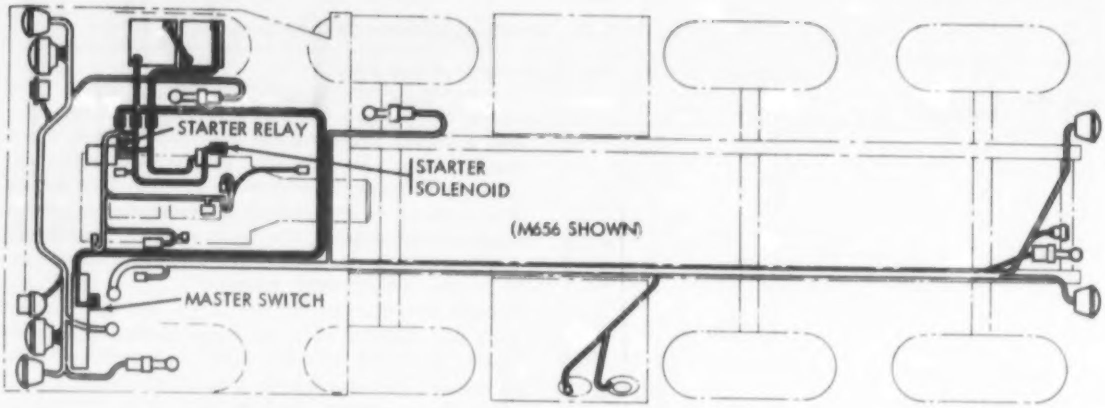
Table 2-5. Troubleshooting the Electrical System—Continued

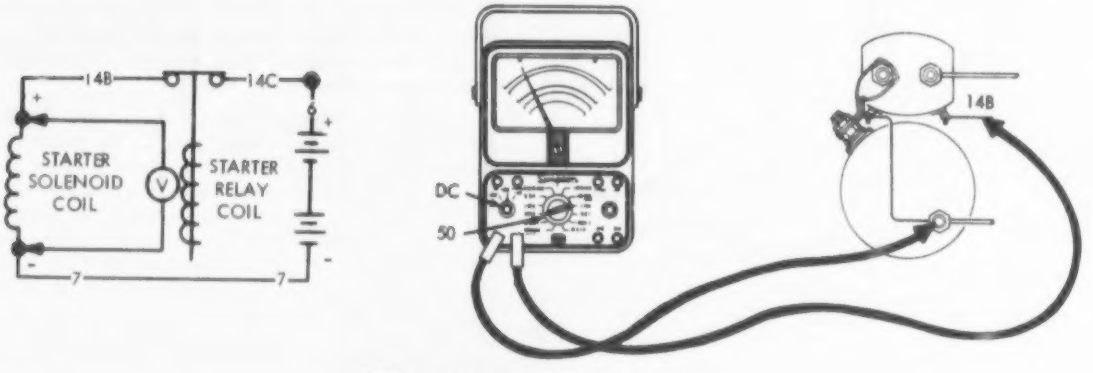
STARTING SYSTEM CIRCUIT—Continued (Figure 2-20)

Malfunction	Circuit	Test
		SECOND CIRCUIT TESTS
Starter fails to crank, or cranks slowly.	14B, 14C, 7	Test 4. Perform starting solenoid coil voltage test. Set up multimeter for voltage test (fig. 2-9). Connect the red test lead to terminal 14B on the starting solenoid, and the black test lead to the starting motor ground terminal, as shown in figure 2-20, test 4. Move engine fuel cutoff switch to far right position and hold it there. Place master switch in "START" position. Listen for "thump" of starting solenoid as it closes the circuit, and note the voltage reading on the meter. If the starting solenoid closes normally and the coil voltage is over 15.5 volts, the solenoid coil circuit is satisfactory. If satisfactory, then begin Third Circuit tests, starting with test 6. If the solenoid does not close normally or chatters, and the voltage is less than 18.5 volts, go to test 5. If the solenoid does not close normally or chatters, but the voltage is over 18.5 volts, the starting solenoid or the starting motor pinion assembly is defective. Replace starter (para 2-90).
Low voltage at starting solenoid coil terminals.	14B, 14C, 7	Test 5. Perform starter relay contacts test. Leave multimeter connected as in test 4. Remove the connector from the starter relay. Install a jumper wire between sockets "B" and "C" in the harness connector just removed, as shown in figure 2-20, test 5. If the starting solenoid operates normally, and the coil voltage is over 18.5 volts, the starter relay has defective contacts. Replace the starter relay. If the starting solenoid coil voltage is less than 18.5 volts, inspect wires 14B and 14C from the starter relay to the starting solenoid for damage or loose connections.

STARTING SYSTEM CIRCUIT—Continued (Figure 2-21)

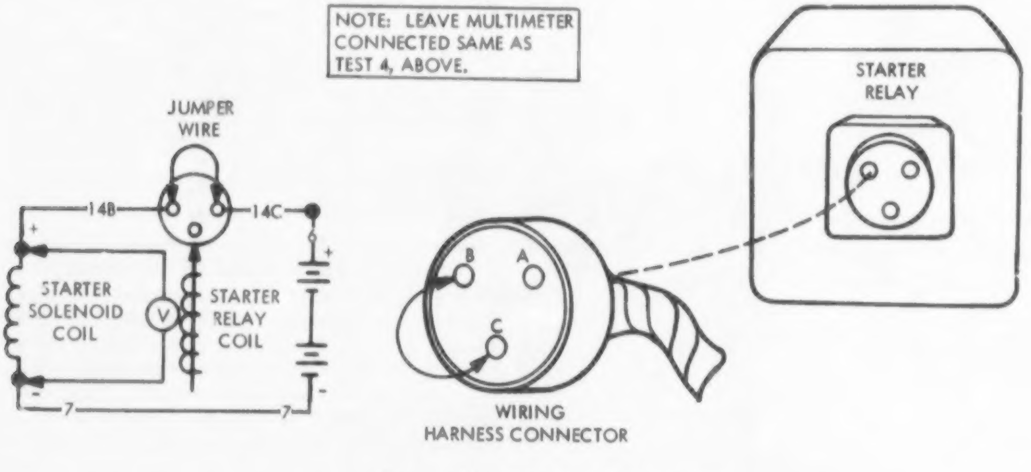
Malfunction	Circuit	Test
		THIRD CIRCUIT TESTS
	6, 14B, 7, 68	Test 6. Perform the starter voltage test. Connect multimeter (50-volt range) between starter terminal and starter frame as shown in figure 2-21, test 6. Move engine fuel cut-off switch to far right position and hold it there. Place master switch in "START" position and crank engine. If reading is 18.5 volts or more, starting solenoid, cables and batteries are not the cause of slow cranking. Check for tight engine by removing inspection plate at bottom of flywheel housing and rotating engine. Refer to paragraph 2-38 for procedure. If engine is free, replace starter. However, if voltage reading at starter is less than 18.5 volts, perform test 7.
	7	Test 7. Perform the battery negative cable test. Connect the voltmeter (50-volt range) between battery negative terminal (circuit 7) and starter frame as shown in figure 2-21, test 7. Move engine fuel cutoff


STARTER RELAY
STARTER SOLENOID
(M656 SHOWN)
MASTER SWITCH


14B
14C
+
+
STARTER SOLENOID COIL
V
STARTER RELAY COIL
-
-
7
7
DC
50
14B

TEST 4. SOLENOID COIL VOLTAGE TEST

NOTE: LEAVE MULTIMETER CONNECTED SAME AS TEST 4, ABOVE.


JUMPER WIRE
14B
14C
+
+
STARTER SOLENOID COIL
V
STARTER RELAY COIL
-
-
7
7
STARTER RELAY
B
A
C
WIRING HARNESS CONNECTOR

TEST 5. STARTER RELAY CONTACTS TEST

AT 12543

Figure 2-20. Starting system tests, second circuit.

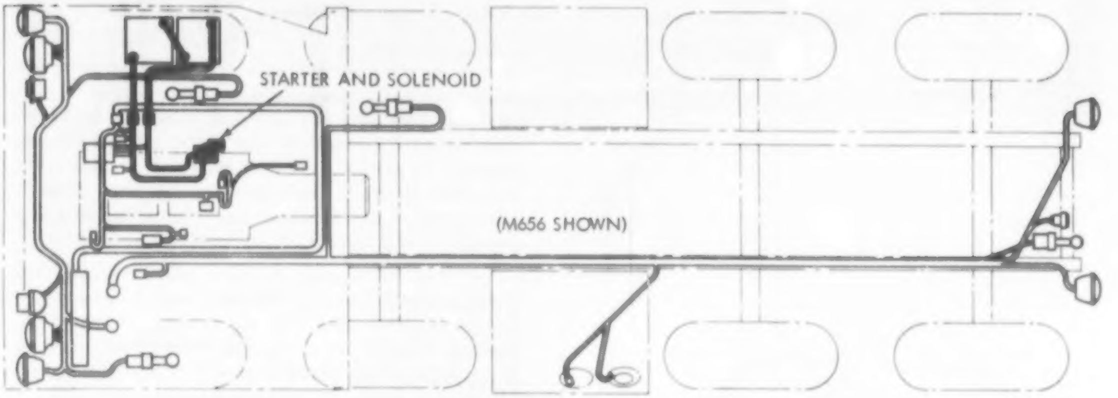
Table 2-5. Troubleshooting the Electrical System—Continued

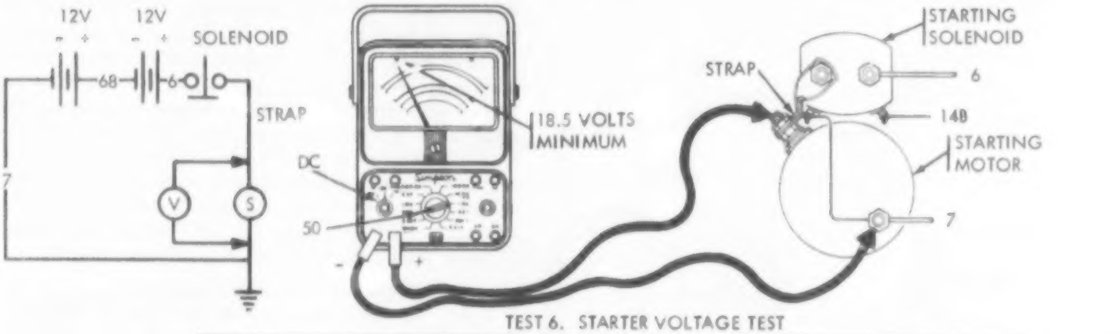
STARTING SYSTEM CIRCUIT—Continued (Figure 2-21)

Malfunction	Circuit	Test
		switch to far right position and hold it there. Place master switch in "START" position and crank engine. If voltmeter shows no or low reading, switch the voltmeter range selector to a lower range until a reading is obtained or the 1-volt range is reached. If reading is more than 0.1 volt, remove battery negative cable and battery terminal post clamp. Clean battery terminal post clamp. Clean battery terminal post and battery terminal post clamp with wire brush. Re-install battery cable and terminal post clamp and tighten all bolts securely to assure a good electrical connection. Perform test again. If the voltage reading is still more than 0.1 volt, follow cable to bulkhead connector and disassemble, inspect and clean both parts of connector. Reassemble connector tightly and retest. If voltage is still more than 0.1 volt, replace complete cable assemblies. If starter still cranks slowly, perform test 8.
	68	Test 8. Perform battery-to-battery cable test. Connect the voltmeter (50-volt range) across the battery-to-battery cable. Contact the actual battery posts, and not the terminal post clamp, with positive and negative test leads as shown in figure 2-21, test 8. Move engine fuel cutoff switch to far right position and hold it there. Place master switch in "START" position and crank engine. If voltmeter shows no or low reading, switch the voltmeter range selector to a lower range until a reading is obtained or the 1-volt range is reached. If reading is 0.1 volt or less, cable is serviceable. If reading is 0.1 volt or more, remove the battery-to-battery cable. Clean both battery terminal posts and the terminal post clamps on the cable with a wire brush. Re-install the cable and tighten all bolts securely to assure a good electrical connection. Perform test again. If the voltage is still more than 0.1 volt, install a new cable, and retest. If the starter still cranks slowly, perform test 9.

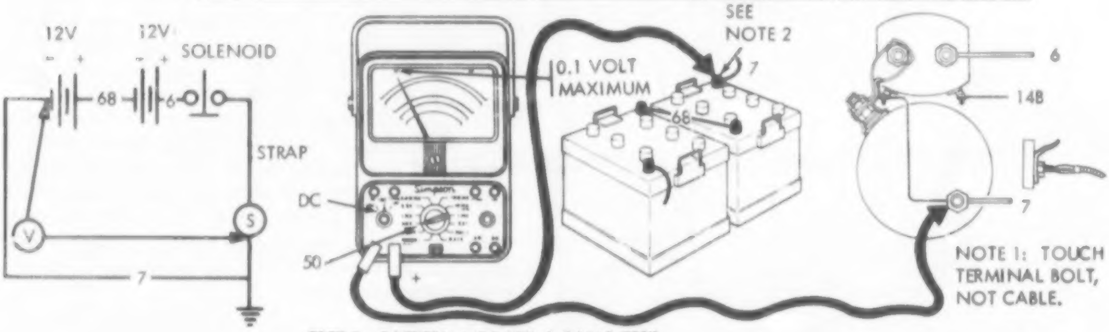
STARTING SYSTEM CIRCUIT—Continued (Figure 2-22)

Malfunction	Circuit	Test
		THIRD CIRCUIT TESTS—Continued
	6	Test 9. Perform battery positive terminal test. Connect the voltmeter (50-volt range) between the battery positive post and its terminal post clamp as shown in figure 2-22, test 9. Move engine fuel cutoff switch to far right position and hold it there. Place master switch in "START" position and crank engine. If the voltmeter shows no or low reading, switch the voltmeter range selector to a lower range until a reading is obtained or the 1-volt range is reached. If the reading is more than 0.1 volt, remove the battery positive terminal post clamp and clean the battery

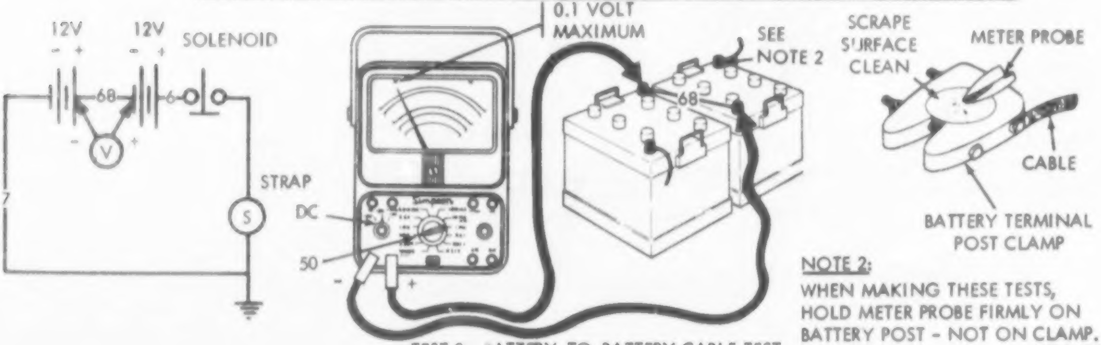

STARTER AND SOLENOID
(M656 SHOWN)


12V
12V
SOLENOID
68
6
STRAP
7
V
S
DC
50
-
+
18.5 VOLTS MINIMUM
STRAP
STARTING SOLENOID
6
14B
STARTING MOTOR
7

TEST 6. STARTER VOLTAGE TEST


12V
12V
SOLENOID
68
6
STRAP
V
S
7
DC
50
+
0.1 VOLT MAXIMUM
SEE NOTE 2
7
68
6
14B
7
NOTE 1: TOUCH TERMINAL BOLT, NOT CABLE.

TEST 7. BATTERY NEGATIVE CABLE TEST


0.1 VOLT MAXIMUM
12V
12V
SOLENOID
68
6
V
-
+
STRAP
S
7
DC
50
-
+
SEE NOTE 2
68
SCRAPE SURFACE CLEAN
METER PROBE
CABLE
BATTERY TERMINAL POST CLAMP

NOTE 2:
WHEN MAKING THESE TESTS, HOLD METER PROBE FIRMLY ON BATTERY POST - NOT ON CLAMP.

TEST 8. BATTERY-TO-BATTERY CABLE TEST

AT 12544

Figure 2-21. Starting system tests, third circuit, (tests 6, 7 & 8).

Table 2-5. Troubleshooting the Electrical System—Continued

STARTING SYSTEM CIRCUIT—Continued (Figure 2-22)

Malfunction	Circuit	Test
		terminal post and the terminal post clamp with a wire brush. Re-install the cable and tighten all bolts securely to assure a good electrical connection. Perform test again. If the voltage is still more than 0.1 volt, install a new terminal post clamp and retest. If the starter still cranks slowly, perform test 10.
	6	Test 10. Perform battery positive cable assembly test. Connect the voltmeter (50-volt range) between the battery positive post and the solenoid terminal post marked "BAT." as shown in figure 2-22, test 10. Move engine fuel cutoff switch to far right position and hold it there. Place master switch in "START" position and hold it there. If the voltmeter shows no or low reading, switch the voltmeter range selector to a lower range until a reading is obtained or the 1-volt range is reached. If the reading is more than 0.1 volt, follow the cable to the bulkhead connector. Disassemble the connector and clean both parts. Reassemble the connector, and inspect the terminal connection at the solenoid for loose connection or frayed wires. Repair if necessary. Perform test again. If the voltage is still more than 0.1 volt, install new cables. If the starter still cranks slowly, perform test 11.
	14B	Test 11. Perform solenoid-to-starting motor strap test. Connect the voltmeter between the solenoid TERMINAL BOLT and the starting motor TERMINAL BOLT, as shown in figure 2-22, test 11. Move engine fuel cutoff switch to far right and hold it there. Place master switch in "START" position and hold it there. If the voltmeter shows no or low reading, switch the voltmeter range selector to a lower range until a reading is obtained or the 1-volt range is reached. If the reading is more than 0.1 volt, remove the strap and clean both ends and both terminal bolts thoroughly with a wire brush. Re-install the strap and tighten the terminal nuts tightly to make a good electrical connection. If starter still cranks slowly, replace starting motor.

Table 2-5. Troubleshooting the Electrical System—Continued

STARTING SYSTEM CIRCUIT—Continued (Figure 2-22)

Malfunction	Circuit	Test
Starter Cranks Continuously.	6, 14B	***Caution:*** **Starting motor terminals and solenoid terminals must be thoroughly coated with RTV to prevent corrosion and electric current leakage.** Check for frayed insulation on cables 6 and 14B where they can touch each other. Check for contact between terminals 6 and 14B at solenoid. (A 1/2-inch space must be maintained.) Check master switch (refer to test 3).

GENERATING SYSTEM CIRCUIT (ALTERNATOR) (Figure 2-23)

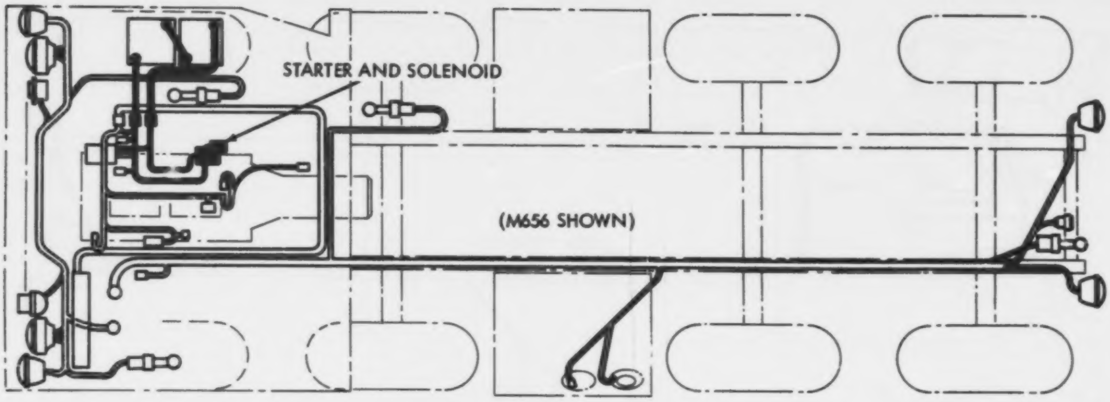
DESCRIPTION: The generating system for the XM757 and the XM791 trucks consists of a basic 30/80 ampere, 24-volt, negative ground alternator with an internal voltage regulator and rectifier assembly. The alternator is permanently connected for 30-ampere output capability by means of a jumper wire between contacts D and E in the alternator connector (fig. 2-23).

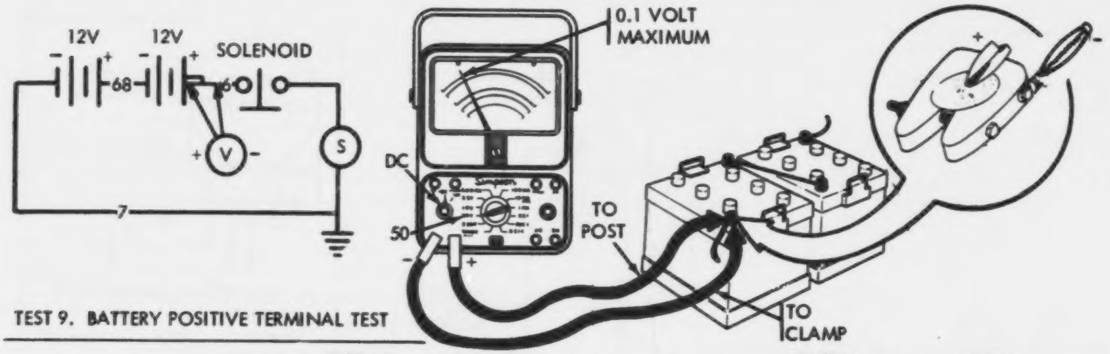
The M656 uses the same alternator, but normal operation is with the 30-ampere output capability. An auxiliary relay changes the internal alternator circuitry to increase the alternator output capability from 30 to 80 amperes (fig. 2-23). This relay is operated by the cab bilge pump switch during the fording operation.

The alternator field is energized by the battery through lead #568 from the master switch. Mechanical rotation of the alternator armature generates 3-phase alternating current (ac). This alternating circuit is changed to direct current (dc) by the rectifier assembly, and the output voltage is maintained at 28 ± 1 volts by the voltage regulator. This 28 volts is used to charge the battery, and to assist the battery in carrying the electrical load of the vehicle.

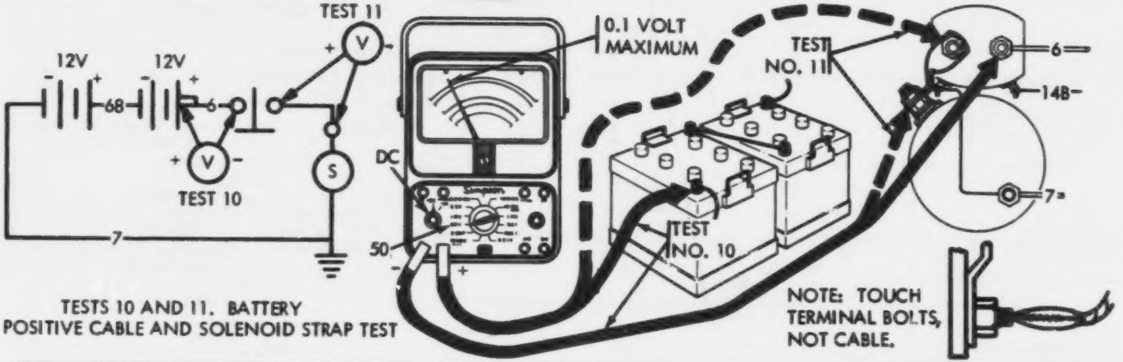
TESTING PRECAUTIONS:

1. The alternator is relatively new and unfamiliar in military vehicles. It is very important that the following precautions are observed to prevent damage to the alternator and regulator.
2. NEVER reverse the battery connections. ALWAYS check the battery connecting cables with a voltmeter before any attachments are made to be sure that the negative cable will be connected to the alternator frame and the positive cable to the alternator positive terminal. Reversal will immediately burn out the rectifiers, which cannot stand the reverse polarity.
3. Booster batteries for cold weather starting must also be properly connected. Make sure that the negative cable of the booster battery connects to the negative terminal of the vehicle battery, and the positive cable to the positive terminal. If in doubt, use a voltmeter to check—NEVER make a trial connection by "flashing" the cable.
4. ALWAYS disconnect the battery cables before connecting a fast charger to the battery.
5. NEVER use a fast charger for starting the engine. Use another battery or a booster made for the express purpose of starting engines.
6. NEVER disconnect the voltage regulator sensing lead (ignition lead No. 568) while the engine is running. This is the only information the regulator has on the battery voltage. If the lead is removed, the alternator will burn itself out trying to reach 28 volts.
7. NEVER ground the alternator output terminal. The internal resistance is very low and an external short circuit will overload all the regulating and generating circuits, resulting in burnout.
8. NEVER operate the alternator with the ignition sensing terminal energized unless a load is connected to the alternator output.
9. NEVER try to polarize an alternator. It is not necessary and could result in expensive damage.
10. NEVER disconnect batteries with engine running.

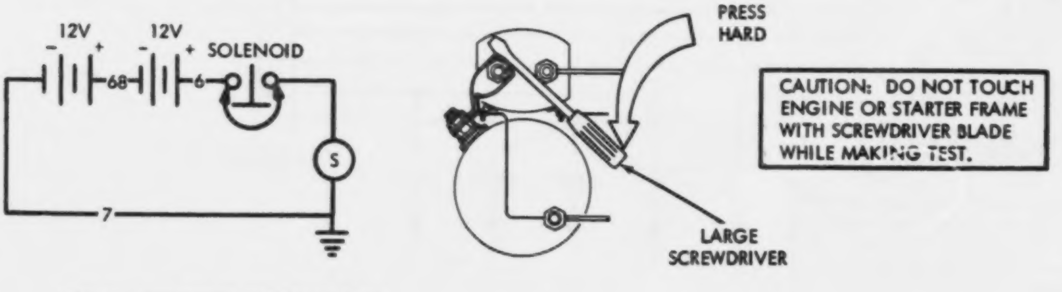

STARTER AND SOLENOID
(M656 SHOWN)


12V
12V
SOLENOID
68
6
V
S
7
0.1 VOLT MAXIMUM
DC
50
TO POST
TO CLAMP

TEST 9. BATTERY POSITIVE TERMINAL TEST


TEST 11
12V
12V
68
6
V
TEST 10
S
7
0.1 VOLT MAXIMUM
DC
50
TEST NO. 11
TEST NO. 10
6
14B
7
NOTE: TOUCH TERMINAL BOLTS, NOT CABLE.

TESTS 10 AND 11. BATTERY POSITIVE CABLE AND SOLENOID STRAP TEST


12V
12V
SOLENOID
68
6
S
7
PRESS HARD
LARGE SCREWDRIVER

CAUTION: DO NOT TOUCH ENGINE OR STARTER FRAME WITH SCREWDRIVER BLADE WHILE MAKING TEST.

TEST 12. SOLENOID CONTACT TEST

AT 12545

Figure 2-22. Starting system tests, third circuit (tests 9 through 11).

best copy available

Reproduced from poor document.

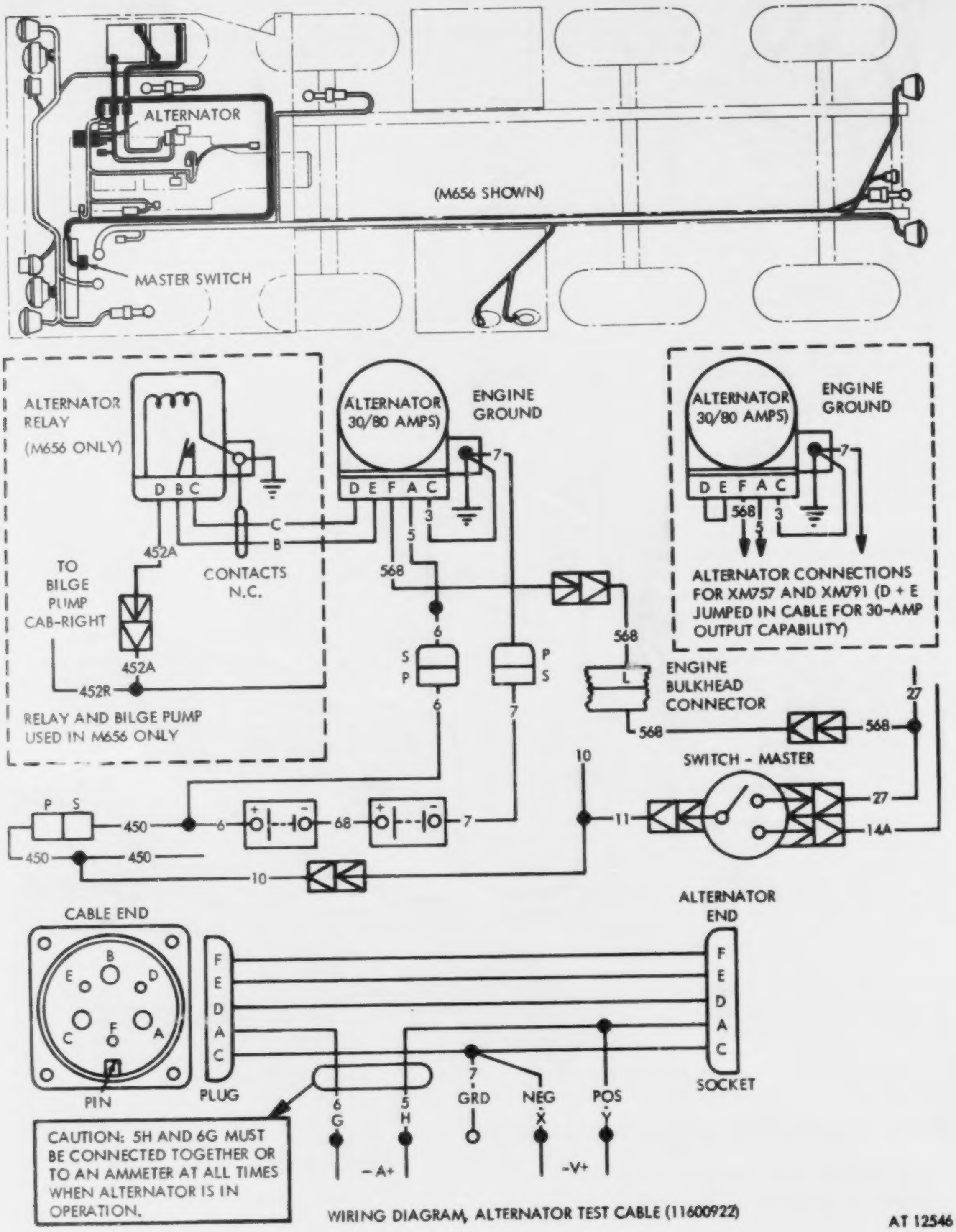

ALTERNATOR
(M656 SHOWN)
MASTER SWITCH
ALTERNATOR RELAY (M656 ONLY)
D B C
C
B
452A
TO BILGE PUMP CAB-RIGHT
CONTACTS N.C.
452A
452R
RELAY AND BILGE PUMP USED IN M656 ONLY
ALTERNATOR 30/80 AMPS)
ENGINE GROUND
D E F A C
7
3
5
568
6
S
P
6
P
S
7
568
L
ENGINE BULKHEAD CONNECTOR
568
ALTERNATOR 30/80 AMPS)
ENGINE GROUND
D E F A C
568
5
3
7
ALTERNATOR CONNECTIONS FOR XM757 AND XM791 (D + E JUMPED IN CABLE FOR 30-AMP OUTPUT CAPABILITY)
27
568
SWITCH - MASTER
10
P S
450
6
68
7
11
27
14A
450
450
10
CABLE END
B
E
D
C
F
A
PIN
PLUG
F E D A C
ALTERNATOR END
F E D A C
SOCKET
6 G
5 H
7 GRD
NEG X
POS Y
− A+
-V+
CAUTION: 5H AND 6G MUST BE CONNECTED TOGETHER OR TO AN AMMETER AT ALL TIMES WHEN ALTERNATOR IS IN OPERATION.
WIRING DIAGRAM, ALTERNATOR TEST CABLE (11600922)
AT 12546

Figure 2-23. Wiring diagram, battery charging circuit.

Table 2-5. Troubleshooting the Electrical System—Continued

GENERATING SYSTEM CIRCUIT (ALTERNATOR)—Continued (Figure 2-24)		
Malfunction	**Circuit**	**Test**
Note. Failure of the alternator usually results in discharged or overcharged batteries. If the batteries become discharged without obvious cause, the alternator may be at fault. Quite often, failure of the alternator may be anticipated by observing the battery-generator indicator.		*Note.* Start and run engine at fast idle until normal temperature is reached. Test 1. Make a visual inspection. Check belt tension (para 2-86*b*), bearings, loose terminals on alternator, batteries and starter switch. Also look for frayed or broken wires, corrosion or any other visible signs or damage, deterioration, or maladjustment. Make any required repairs before proceeding with further tests. *Note.* Test batteries for good condition before further testing.
	3, 5, 568	Test 2. Perform alternator output test. Start the engine and run it at 1000 to 2000 rpm for 15 minutes, then shut it off. Disconnect harness connector from alternator. Set the voltmeter range selector on the 50-volt setting. Touch the positive (red) test lead to socket "F" of the harness connector. Connect the negative (black) test lead to the alternator frame (see test 2A). Turn on the master switch (DO NOT START THE ENGINE). The voltmeter should indicate 24 ± 1 volts. If the voltmeter indicates no or very low volts, repair or replace wire No. 568 and retest. When 24 volts is indicated, insert alternator test cable (fig. 2-1), as shown in figure 2-24, test 2B. Connect test cable leads marked POS-Y and NEG-X to the voltmeter terminals, the lead marked 5-H to ammeter + common terminal and the lead marked 6-G to ammeter −100 terminal. Connect the lead marked GRD to the ground terminal of the alternator. Be sure no bare wires are touching the engine or frame. ***Caution:*** **Do not run engine with leads 5-H and 6-G disconnected. Severe damage to the alternator will occur.** Restart engine. The voltmeter should indicate 28 ± 1 volts and the ammeter 2 to 20 amperes. If the voltage reading is less than 24 volts, or the alternator has not output, replace the alternator. If the alternator output is greater than 28.5 volts, or less than 27.5 volts, remove the plug from the front flange of the alternator. Adjust the output control until the voltmeter indicates exactly 28 volts. Then perform test 3, alternator load test. If the output voltage cannot be adjusted to this voltage, replace the alternator. Test 3. Perform alternator load test. Connect the low voltage circuit tester as shown in figure 2-24, test 3. Be sure the voltmeter is on the 50-volt range, the ammeter on the 100-ampere range, and the load bank switch in "OFF" position. Set the coarse load control to "OFF" or minimum counterclockwise position. Start the engine and run at 1000-2000 rpm. Set the load bank switch to "ON" position and adjust the load control until the ammeter indicates 25 amperes. Note the voltmeter indication at this time. If the voltmeter indicates 27 to 29 volts, the alternator is operating satisfactorily. If the voltmeter indicates

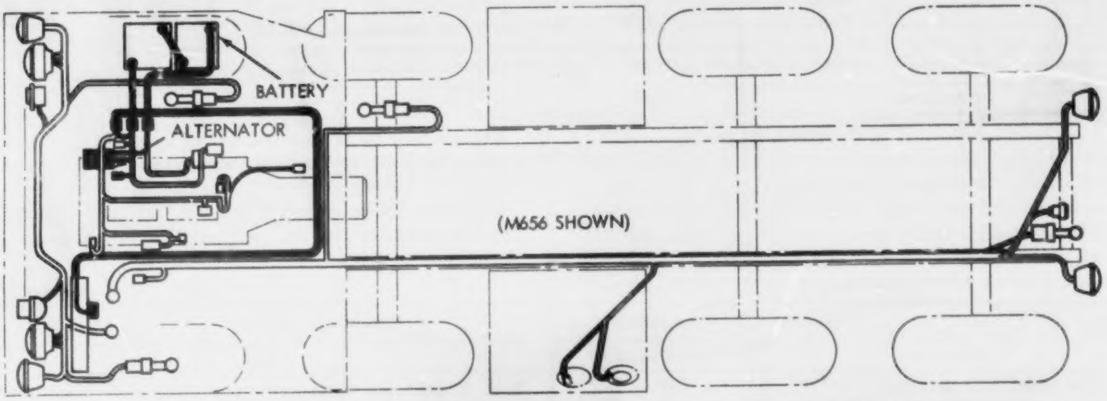
Table 2-5. Troubleshooting the Electrical System—Continued

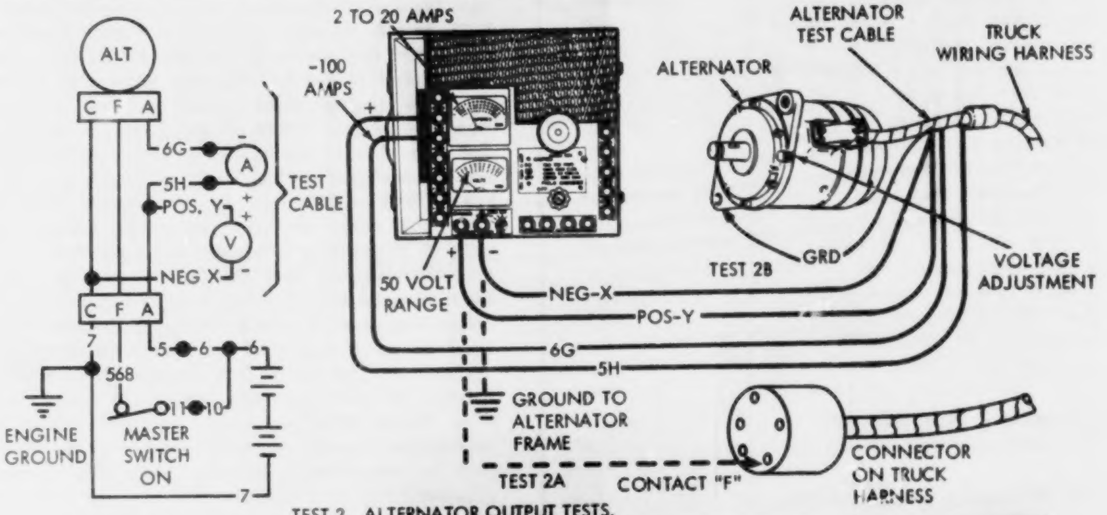
GENERATING SYSTEM CIRCUIT (ALTERNATOR)—Continued (Figure 2-24)

Malfunction	Circuit	Test
		slightly less than 27 volts, or more than 29 volts, remove the plug at the front of the alternator and adjust the output control to exactly 28 volts. If the voltmeter indicates much less than 27 volts and cannot be raised to 28 volts, perform the cable tests.

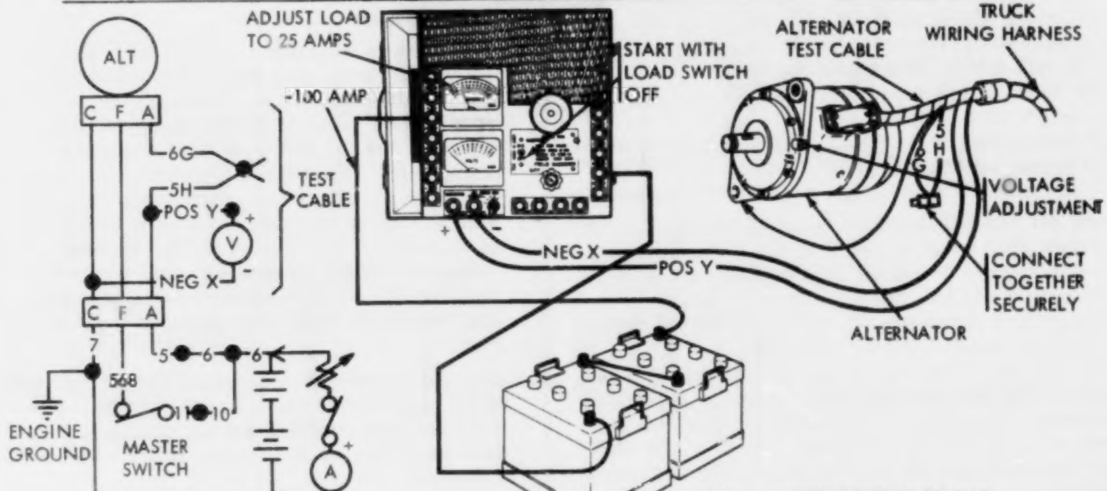
GENERATING SYSTEM CIRCUIT (ALTERNATOR)—Continued (Figure 2-25)

Malfunction	Circuit	Test
Alternator low output.		Test 4. Perform alternator-to-battery cable test. Connect the low voltage circuit tester as shown in figure 2-25, test 4. Remove the alternator cable connector and insert the alternator test cable (fig. 2-1). Connect leads 5-H and 6-G together for a good connection. Use a good jumper wire, or a nut, bolt and washer assembly tightened securely. Do not allow this connection or the POS-Y terminals to touch the vehicle or engine frame. Start the engine and let it run at 1000 to 2000 rpm for 15 minutes. Turn the load bank switch to "ON" and adjust load control until 25 amperes is indicated on the ammeter. Connect the voltmeter from the junction of 5-H, 6-G to the battery positive terminal POST. Adjust the voltmeter range switch until a reading is obtained or the 1-volt range is reached. If the meter reading exceeds 1.0 volt, turn off engine and examine all connections between the alternator and battery for loose connections, frayed wires and dirt. Clean and tighten all connections. Install new cables where necessary. Repeat the test. When a 1.0 volt or less drop has been obtained, and test 3 indicates that the alternator output is still much less than 27 volts, perform the alternator negative cable test. Test 5. Perform alternator negative cable test. Set up low voltage tester as in test 4. Connect the voltmeter from the alternator frame (well scraped) to the negative battery terminal POST. Start the engine and run it at 1000 to 2000 rpm until it regains normal temperature. Adjust the voltmeter range switch until a reading is obtained or until the 1-volt range is reached. Adjust the load bank control until a reading of 25 amperes is indicated on the ammeter. If the voltmeter reading exceeds 0.2 volt, turn off engine and examine all connections between the alternator and battery for loose connections, frayed wires and dirt. Clean and tighten all connections. Install new cables where necessary. Repeat the test. When a 0.2 volt drop has been obtained, and the alternator output is still much less than 27 volts, perform the battery cable test.


BATTERY
ALTERNATOR
(M656 SHOWN)


ALT
C F A
6G
5H
POS. Y
NEG X
A
V
TEST CABLE
C F A
7
568
5
6
6
11
10
7
ENGINE GROUND
MASTER SWITCH ON
2 TO 20 AMPS
-100 AMPS
+
50 VOLT RANGE
+
-
NEG-X
POS-Y
6G
5H
GROUND TO ALTERNATOR FRAME
TEST 2A
CONTACT "F"
ALTERNATOR
ALTERNATOR TEST CABLE
TRUCK WIRING HARNESS
TEST 2B
GRD
VOLTAGE ADJUSTMENT
CONNECTOR ON TRUCK HARNESS

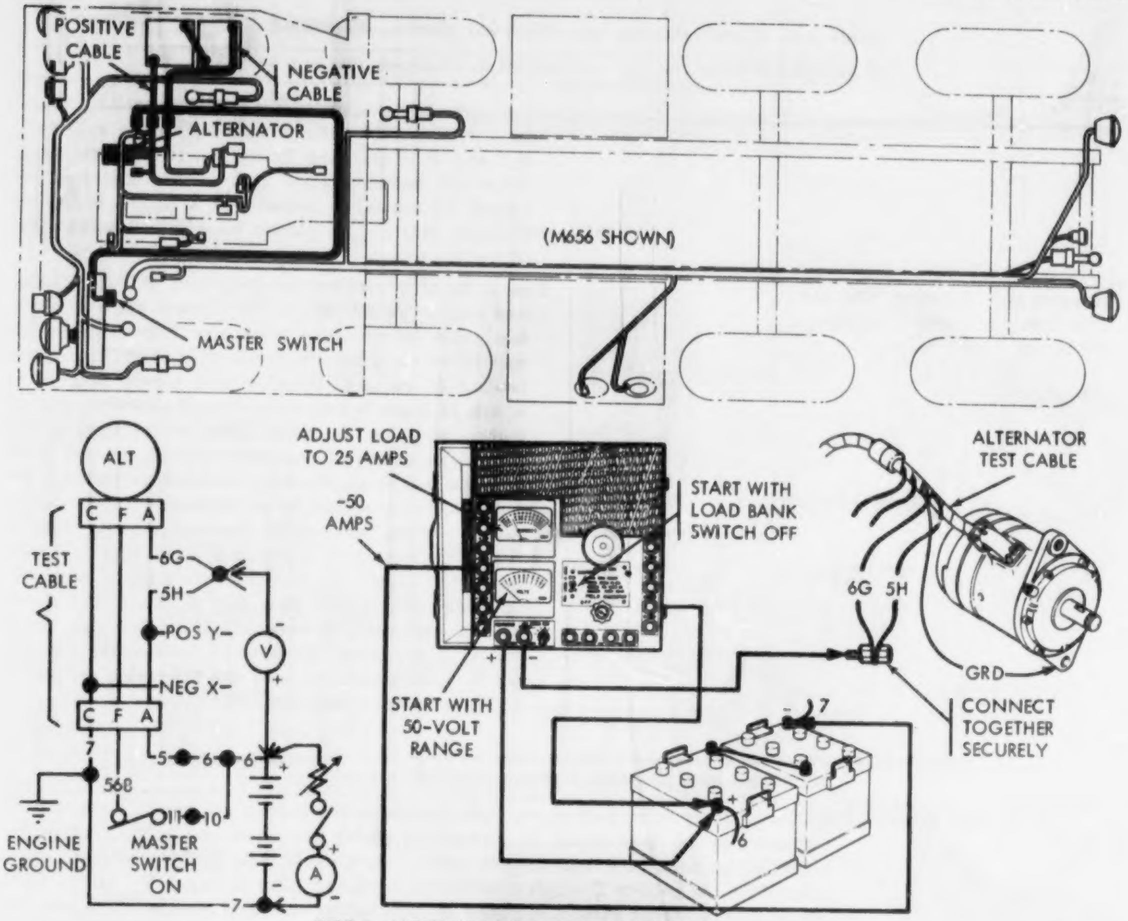
TEST 2. ALTERNATOR OUTPUT TESTS.


ALT
C F A
6G
5H
POS Y
NEG X
V
TEST CABLE
C F A
7
568
5
6
6
11
10
7
A
ENGINE GROUND
MASTER SWITCH
ADJUST LOAD TO 25 AMPS
-100 AMP
START WITH LOAD SWITCH OFF
+
-
NEG X
POS Y
ALTERNATOR TEST CABLE
TRUCK WIRING HARNESS
5H
6G
VOLTAGE ADJUSTMENT
CONNECT TOGETHER SECURELY
ALTERNATOR

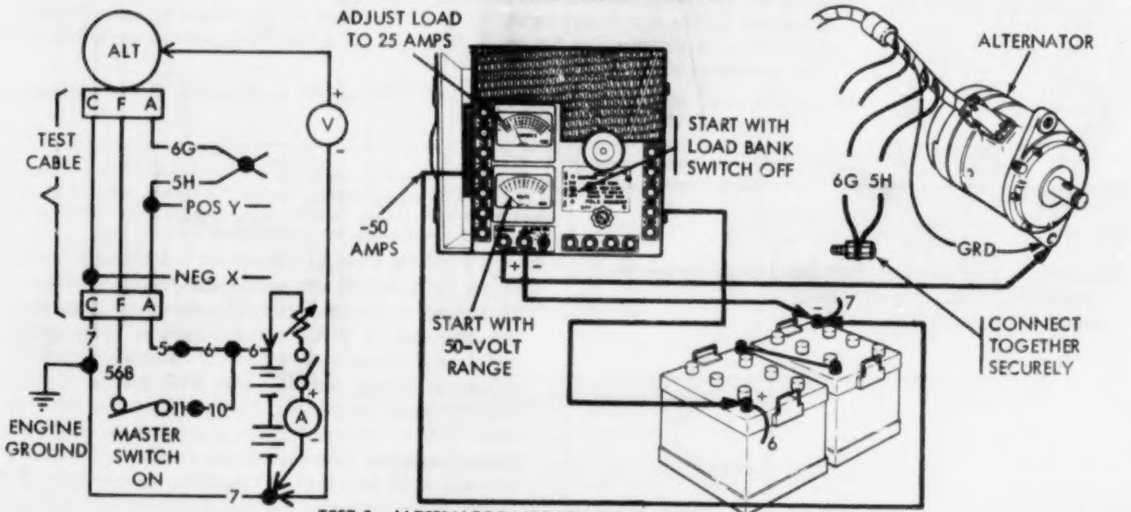
TEST 3. ALTERNATOR LOAD TEST

AT 12547

Figure 2-24. Alternator system tests 1 through 3.


POSITIVE CABLE
NEGATIVE CABLE
ALTERNATOR
(M656 SHOWN)
MASTER SWITCH
ALT
C F A
TEST CABLE
6G
5H
POS Y
NEG X
C F A
7
5
6
6
568
11
10
ENGINE GROUND
MASTER SWITCH ON
V
A
7
ADJUST LOAD TO 25 AMPS
-50 AMPS
START WITH LOAD BANK SWITCH OFF
START WITH 50-VOLT RANGE
ALTERNATOR TEST CABLE
6G 5H
GRD
CONNECT TOGETHER SECURELY
7
6

TEST 4. ALTERNATOR-TO-BATTERY CABLE TEST


ALT
C F A
TEST CABLE
6G
5H
POS Y
NEG X
C F A
7
5
6
6
568
11
10
ENGINE GROUND
MASTER SWITCH ON
V
A
7
ADJUST LOAD TO 25 AMPS
-50 AMPS
START WITH LOAD BANK SWITCH OFF
START WITH 50-VOLT RANGE
ALTERNATOR
6G 5H
GRD
CONNECT TOGETHER SECURELY
7
6

TEST 5. ALTERNATOR NEGATIVE CABLE TEST

AT 12548

Figure 2-25. Alternator system tests, 4 and 5.

Table 2-5. *Troubleshooting the Electrical System*—Continued

GENERATING SYSTEM CIRCUIT (ALTERNATOR)—Continued (Figure 2-26)

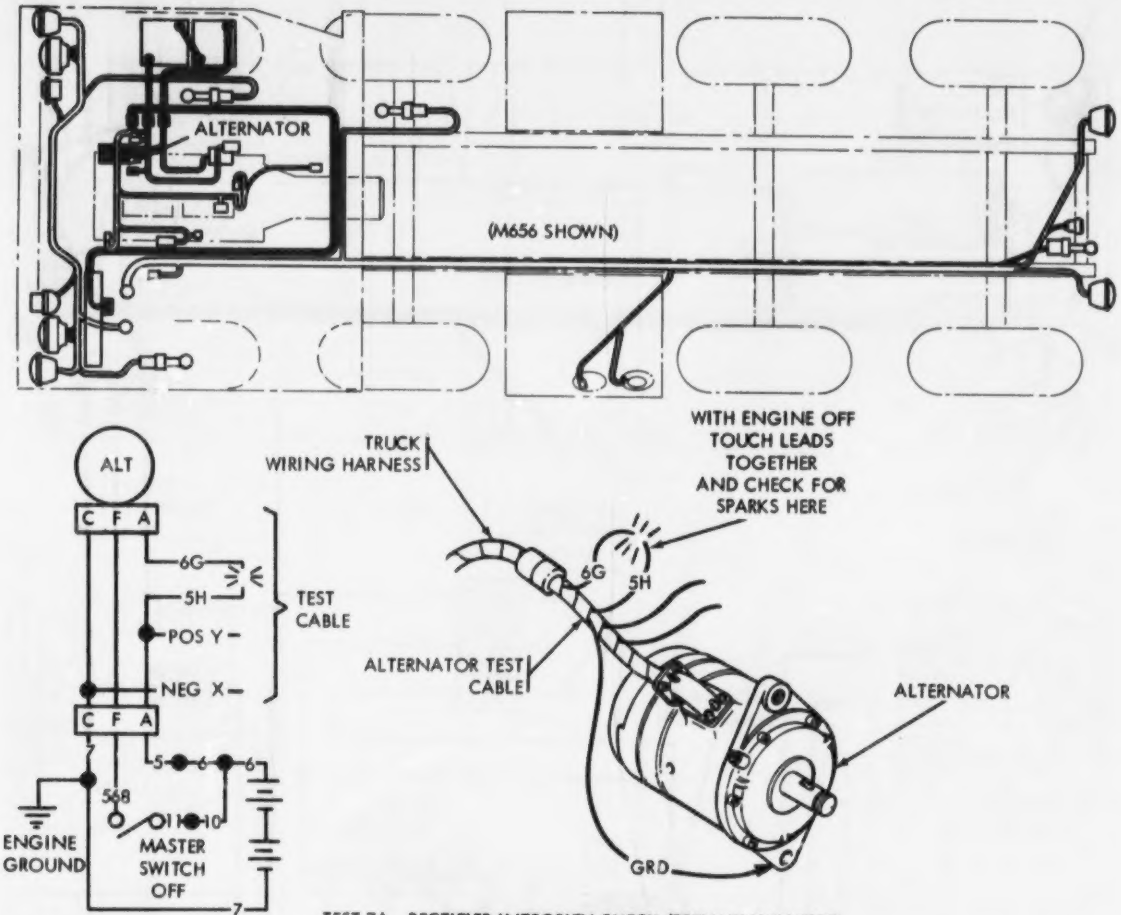
Malfunction	Circuit	Test
	6, 7, 68	Test 6. Perform the battery cable test. Refer to tests 7, 8, 9 and 10 of Starting Tests, figures 2-21 and 2-22. When all battery cables have been tested and repaired (if required), repeat test 3, above. If the alternator output still cannot be adjusted to at least 27.5 volts, replace alternator.
Alternator not charging, and battery discharges even if vehicle is not in use.	5, 6	Test 7. Perform rectifier integrity test. Be sure engine and master switch are "OFF". Insert the alternator test cable between the alternator output connector and cable, as shown in figure 2-26, test 7A. Touch leads 5-H and 6-G together and slowly pull them apart. If there is any indication of sparking, one or more diodes, or the radio interference suppression filter is defective. If no sparks appear, connect leads 5-H and 6-G to an ammeter as shown in figure 2-26, test 7B. There should be no indication on the meter except a small jump at the moment of connection. If there is a sustained meter indication (over 0.1 ampere) the alternator has internal leakage and will discharge the battery in a day or two. If the meter has an indication, however slight, replace the alternator. If the meter shows no indication, the alternator is satisfactory. Remove the test cable and reinstall the vehicle alternator cable.

LIGHTING SYSTEM CIRCUIT (Figure 2-27, 2-28, and 2-29)

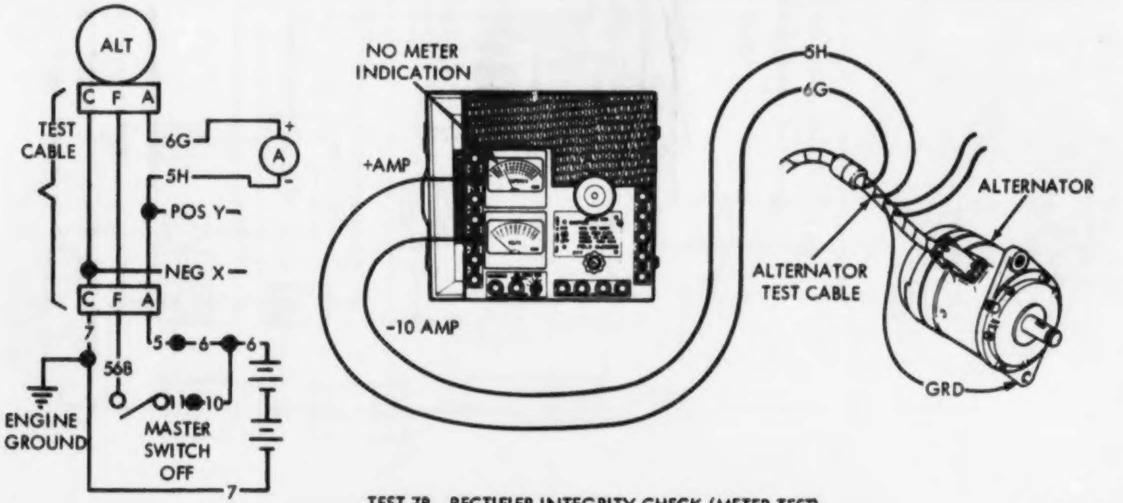
DESCRIPTION: Light circuits are controlled by the light switch on the instrument panel. Each light is connected to the light switch by connectors, wiring harnesses and cables; cables are identified by numbered tags near the end of each cable. The light circuits are energized from the battery through circuits 6, 450, 10 and 15 to terminal "F" on the light switch. Individual or groups of lights are selected by the light switch. When selected by the light switch, the stoplight is energized by an air-operated switch in the brake system, or by the directional signal system, which has an individual actuator/selector on the steering column. See figures 2-27, 2-28, and 2-29, for simplified electrical diagrams of the lighting system.

To test the operation of the lighting system, refer to TM 9-2320-230-10 for operating instructions for the light switch.

Malfunction	Circuit	Test
		Note. Before troubleshooting the lighting system, refer to the TM 9-2320-230-10 to become familiar with the lighting arrangement for each switch position and the nomenclature for each light.
Generally unsatisfactory lighting (flickering, dim, frequent burnouts, intermittent).	6, 5, 15, 17, 13, 91, 21, 22, 23, 24	Test 1. Perform a visual inspection. Inspect connections at the light switch and each individual light. Inspect all ground connections at light assemblies. If grounds are corroded or dirty, remove ground wire, scrape metal until clean, and reconnect, tightening securely. After tightening, coat the area with grease or other rust-reducing compound. If the complaint is short lamp life, or frequent burnout of lamps, check for high generating system voltage (refer to fig. 2-24), or loose lamp housings or operating components that would cause excessive vibration. Before discarding a


ALTERNATOR
(M656 SHOWN)
ALT
C F A
6G
5H
POS Y
NEG X
TEST CABLE
C F A
5
6
6
7
568
11
10
ENGINE GROUND
MASTER SWITCH OFF
7
TRUCK WIRING HARNESS
WITH ENGINE OFF TOUCH LEADS TOGETHER AND CHECK FOR SPARKS HERE
6G
5H
ALTERNATOR TEST CABLE
ALTERNATOR
GRD

TEST 7A. RECTIFIER INTEGRITY CHECK (PRELIMINARY TEST)


ALT
C F A
TEST CABLE
6G
A
+
-
5H
POS Y
NEG X
C F A
7
5
6
6
568
11
10
ENGINE GROUND
MASTER SWITCH OFF
7
NO METER INDICATION
+AMP
-10 AMP
5H
6G
ALTERNATOR
ALTERNATOR TEST CABLE
GRD

TEST 7B. RECTIFIER INTEGRITY CHECK (METER TEST)

AT 12549

Figure 2-26. Alternator system test 7.

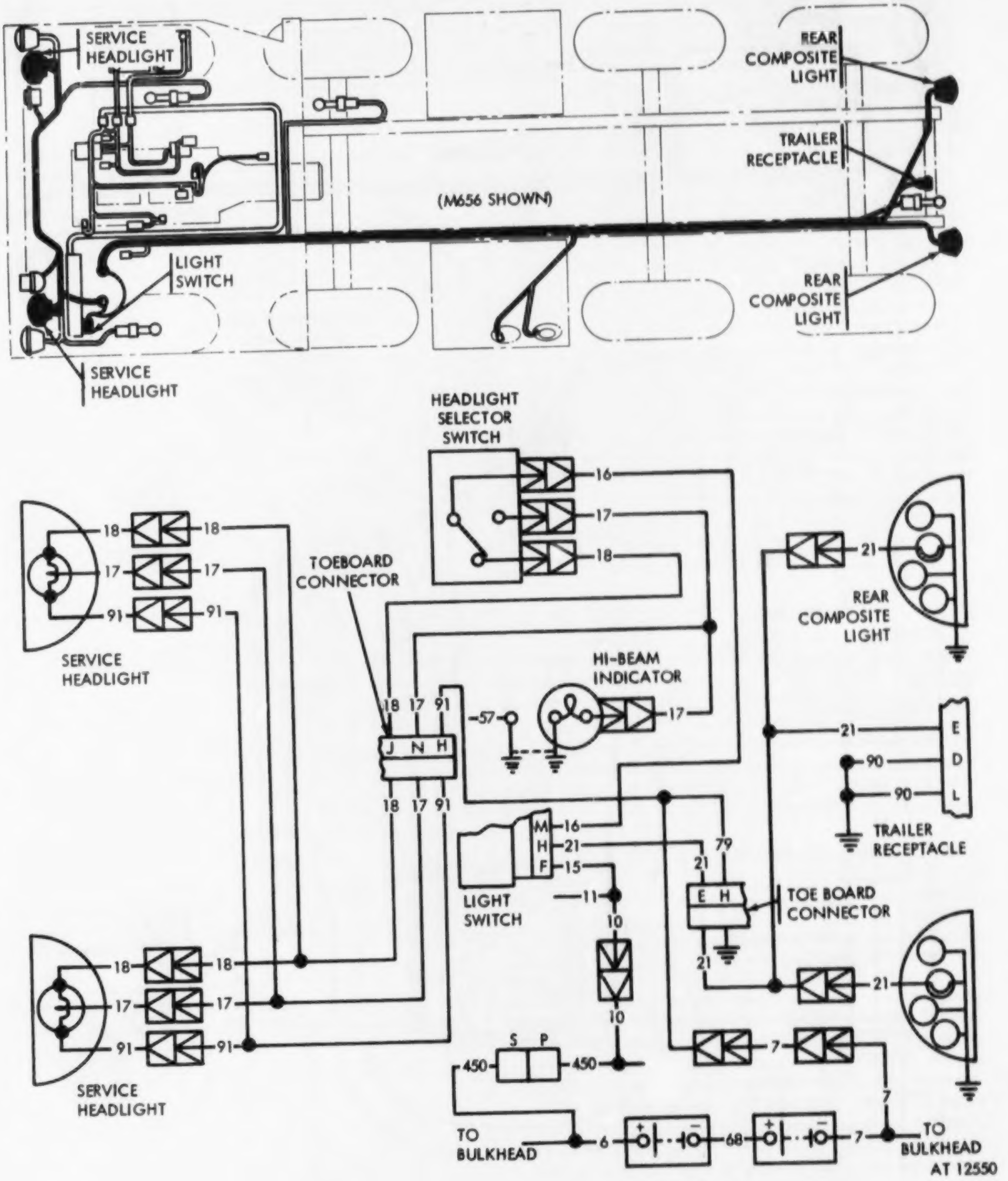
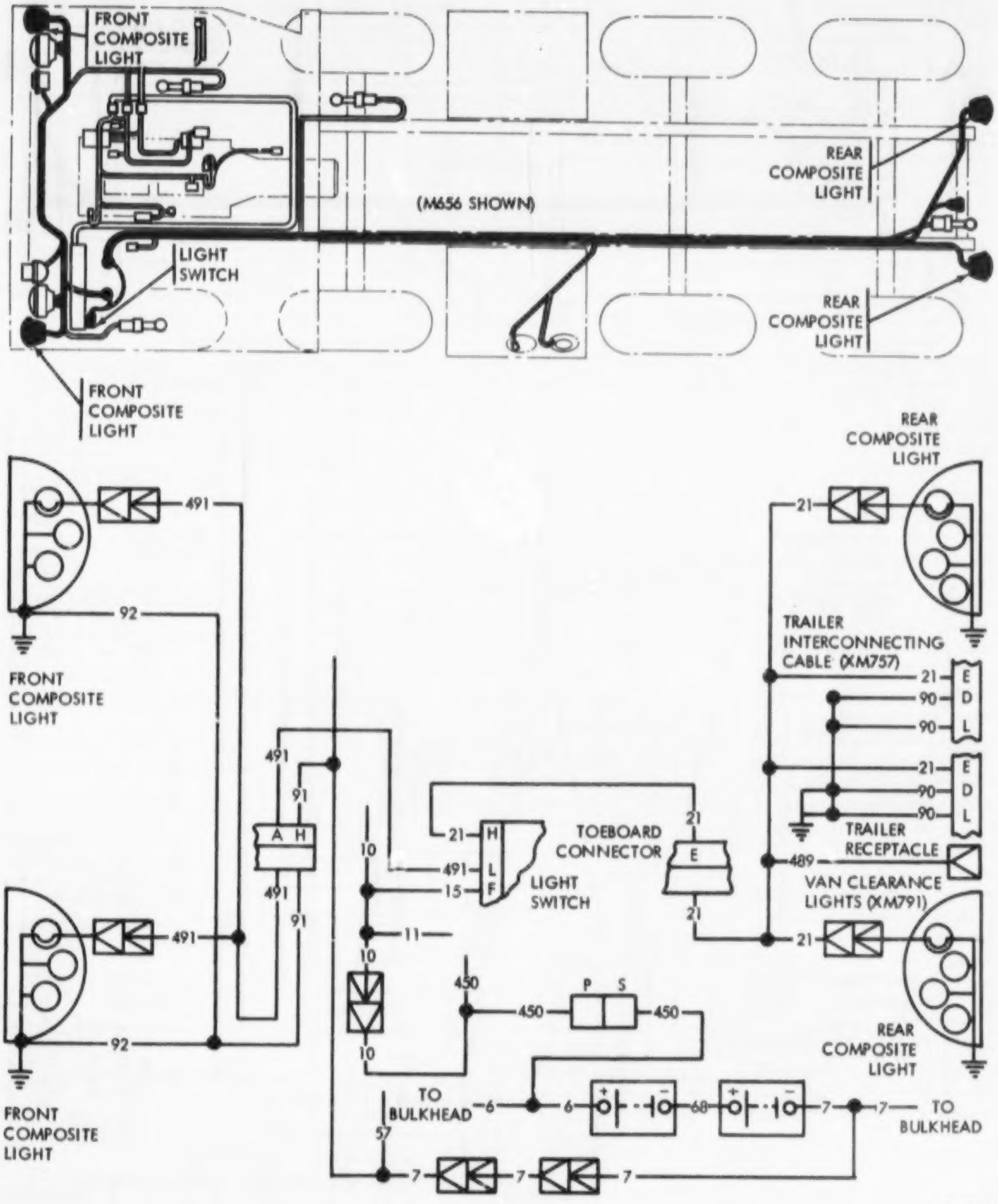

SERVICE HEADLIGHT
REAR COMPOSITE LIGHT
TRAILER RECEPTACLE
(M656 SHOWN)
LIGHT SWITCH
REAR COMPOSITE LIGHT
SERVICE HEADLIGHT
HEADLIGHT SELECTOR SWITCH
16
17
18
18
17
91
SERVICE HEADLIGHT
TOEBOARD CONNECTOR
18 17 91
J N H
18 17 91
57
HI-BEAM INDICATOR
17
21
REAR COMPOSITE LIGHT
21
E
90
D
90
L
TRAILER RECEPTACLE
M 16
H 21
F 15
LIGHT SWITCH
11
10
79
21
E H
TOE BOARD CONNECTOR
21
10
18
17
91
SERVICE HEADLIGHT
21
7
S P
450
450
7
TO BULKHEAD
6
68
7
TO BULKHEAD
AT 12550

Figure 2–27. Service headlamps circuit, wiring diagram.


FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
(M656 SHOWN)
LIGHT SWITCH
REAR COMPOSITE LIGHT
FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
491
21
92
FRONT COMPOSITE LIGHT
TRAILER INTERCONNECTING CABLE (XM757)
21 E
90 D
90 L
21 E
90 D
90 L
491
91
A H
21 H
491 L
15 F
10
TOEBOARD CONNECTOR
E
21
TRAILER RECEPTACLE
489
LIGHT SWITCH
VAN CLEARANCE LIGHTS (XM791)
491
91
11
491
21
10
450
P S
450
450
REAR COMPOSITE LIGHT
92
10
FRONT COMPOSITE LIGHT
TO BULKHEAD
6
6
68
7
7
TO BULKHEAD
57
7
7
7
+
−
+
−

AT 12551

Figure 2-28. Service parking lamps circuit, wiring diagram.

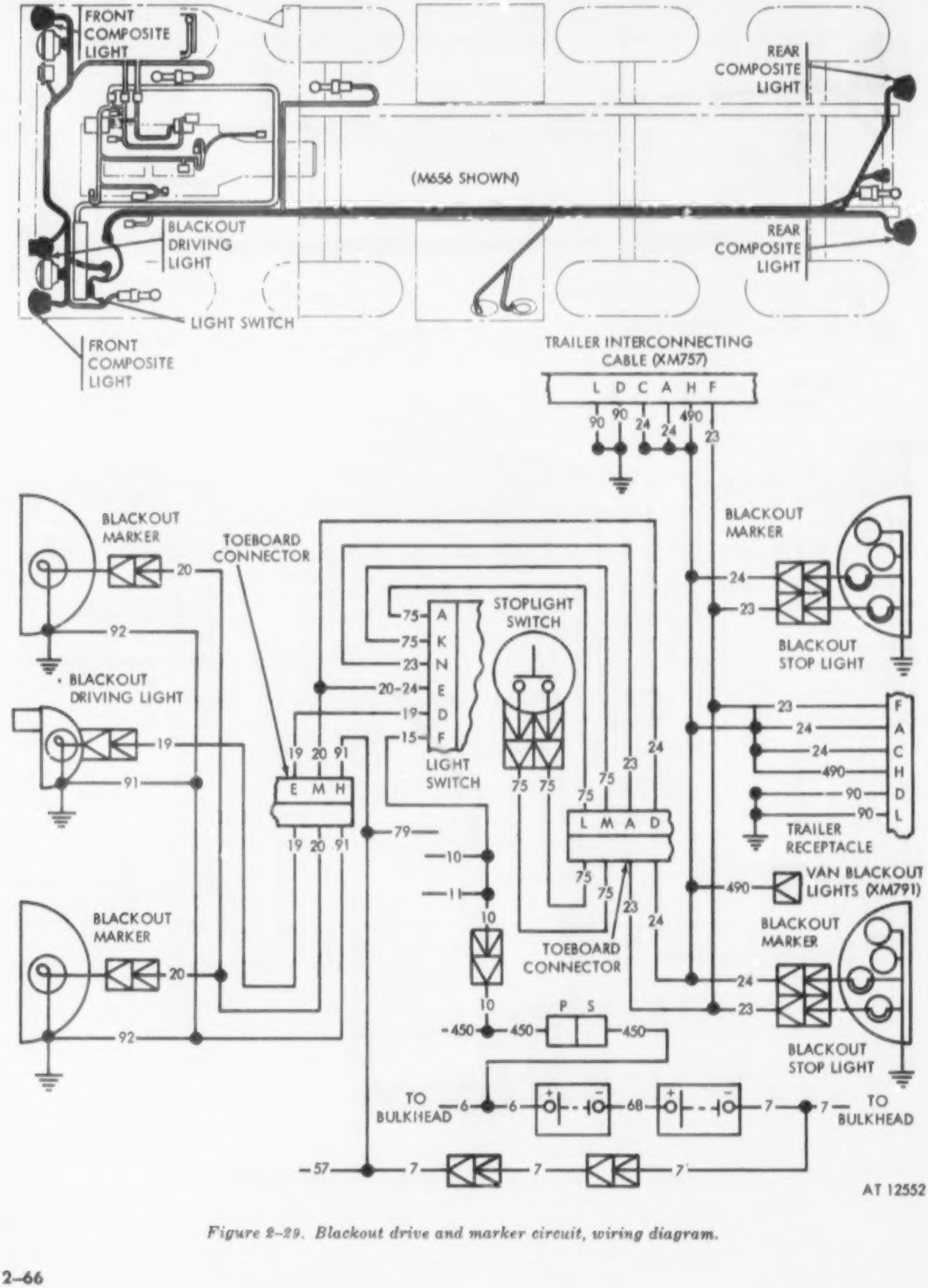

FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
(M656 SHOWN)
BLACKOUT DRIVING LIGHT
REAR COMPOSITE LIGHT
LIGHT SWITCH
FRONT COMPOSITE LIGHT
TRAILER INTERCONNECTING CABLE (XM757)
L D C A H F
90 90 24 24 490 23
BLACKOUT MARKER
TOEBOARD CONNECTOR
BLACKOUT MARKER
BLACKOUT STOP LIGHT
STOPLIGHT SWITCH
BLACKOUT DRIVING LIGHT
A K N E D F
LIGHT SWITCH
E M H
L M A D
TRAILER RECEPTACLE
F A C H D L
VAN BLACKOUT LIGHTS (XM791)
BLACKOUT MARKER
TOEBOARD CONNECTOR
BLACKOUT MARKER
BLACKOUT STOP LIGHT
P S
TO BULKHEAD
TO BULKHEAD
AT 12552

Figure 2-29. Blackout drive and marker circuit, wiring diagram.

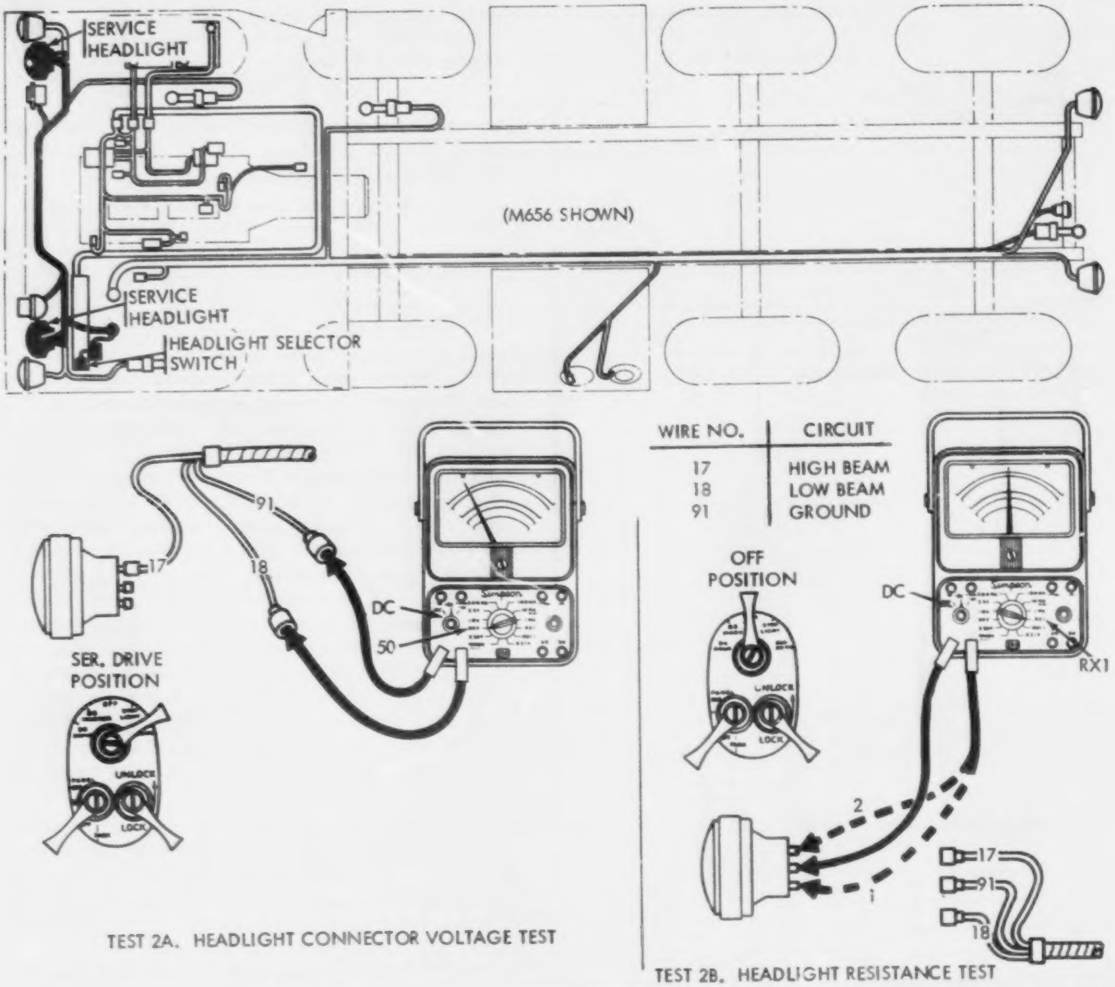
Table 2-5. Troubleshooting the Electrical System—Continued

LIGHTING SYSTEM CIRCUIT—Continued (Figure 2-27, 2-28, and 2-29)

Malfunction	Circuit	Test
		lamp that has been removed, test it in another light socket, or with an ohmmeter, to determine whether the lamp or socket is at fault. *Note.* The following voltage tests may be performed with either the multimeter, or the voltmeter section of the low voltage circuit tester.

LIGHTING SYSTEM CIRCUIT—Continued (Figure 2-30)

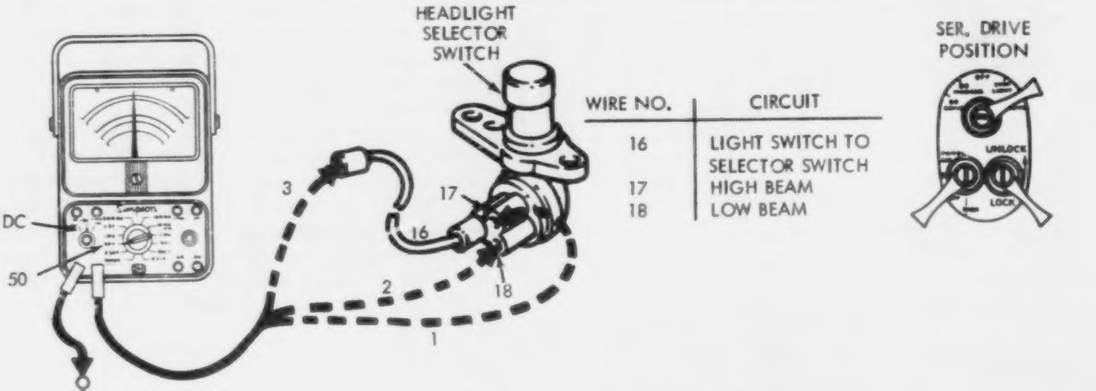
Malfunction	Circuit	Test
Headlight (one side) inoperative.	17, 18, 91	Test 2. Perform service headlamp connector voltage test. Disconnect connector and connect voltmeter as shown in figure 2-30, test 2A. Turn lighting switch to "SER DRIVE" position. If no voltage is indicated, operate selector switch. If no reading is indicated in either position of the selector switch, the wiring harness from headlamp to selector switch, or the switch itself, is unserviceable. (See test 3.) If 24 volts is indicated, make a resistance test of the lamp unit. Turn light switch to "OFF". Connect the multimeter between lamp terminals 91 and 18, as shown in figure 2-30, test 2B. If the multimeter needle moves past the center of the scale, connect the leads between terminals 91 and 17, and repeat. If the needle does not move with either test, replace the lamp. If replacement lamp unit does not light, inspect the pin connector of headlamp body for corrosion or loose connections.
Headlights (both sides) inoperative.	16, 17, 18	Test 3. Perform service headlamp voltage test (both sides). Check for voltage at connectors of both lamps as in test 2. If voltage is not present, disconnect No. 17 and No. 18 wires at selector switch. Connect voltmeter as shown in figure 2-30, test 3. Check for voltage at exposed terminal No. 17 of the selector switch. If voltage is not present, actuate switch. Repeat this step for exposed terminal No. 18 of the selector switch. If 24-volt reading is indicated at No. 17 and No. 18 switch terminals, but not at headlamp connectors, wiring harness from headlamps to selector switch is unserviceable. If voltage readings are not present at No. 17 and No. 18 selector switch terminals, remove No. 16 wire and connect the positive lead of the voltmeter to the No. 16 wire (not the selector switch terminals), to see if supply voltage is present. If 24 volts is indicated, replace selector switch; if no voltage is indicated, perform lighting switch connector voltage test (fig. 2-33, test 9) to determine if wiring harness from selector switch to lighting switch is unserviceable.


SERVICE HEADLIGHT
(M656 SHOWN)
SERVICE HEADLIGHT
HEADLIGHT SELECTOR SWITCH
17
91
18
DC
50
SER. DRIVE POSITION
OFF POSITION
DC
RX1
2
1
17
91
18

WIRE NO.	CIRCUIT
17	HIGH BEAM
18	LOW BEAM
91	GROUND

TEST 2A. HEADLIGHT CONNECTOR VOLTAGE TEST

TEST 2B. HEADLIGHT RESISTANCE TEST


HEADLIGHT SELECTOR SWITCH
SER. DRIVE POSITION
DC
50
3
17
16
2
18
1
TO VEHICLE GROUND

WIRE NO.	CIRCUIT
16	LIGHT SWITCH TO SELECTOR SWITCH
17	HIGH BEAM
18	LOW BEAM

TEST 3. HEADLIGHT SELECTOR SWITCH TEST.

AT 12553

Figure 2–30. Lighting system tests, 2 and 3.

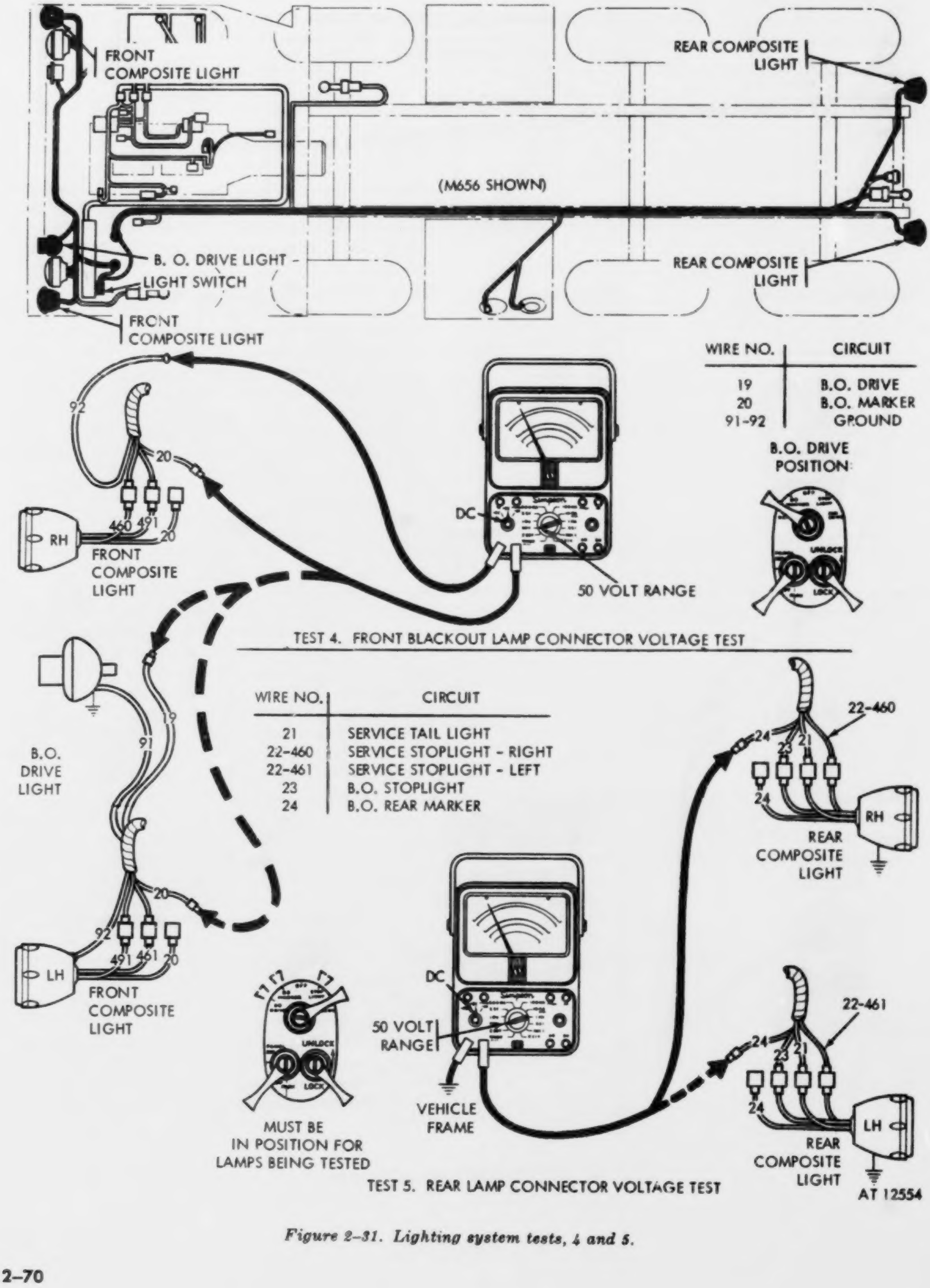
Table 2-5. Troubleshooting the Electrical System—Continued

LIGHTING SYSTEM CIRCUIT—Continued (Figure 2-31)

Malfunction	Circuit	Test
Blackout and marker lights inoperative.	19, 20, 91, 491	Test 4. Perform front blackout lamp connector voltage test. Connect voltmeter as shown in figure 2-31, test 4. Turn light switch to "BO DRIVE" position. If 24 to 28 volts is indicated, replace bulb, if new bulb does not light, check for corroded, dirty or defective socket and wire assembly. If no reading is indicated, perform lighting switch connector voltage test (fig. 2-33, test 9) to determine if wiring harness is unserviceable.
Rear lights inoperative.	21, 22, 23, 24	Test 5. Perform rear lamp connector voltage test. Connect the voltage as shown in figure 2-31, test 5. Turn lighting switch to position corresponding to position of faulty rear lamp; if stoplight, depress brake pedal. If 24 to 28 volts is indicated, replace bulb; if new bulb does not light, check for corroded, dirty or defective socket and wire assembly. If no voltage reading is indicated, perform lighting switch connector voltage test (fig. 2-33, test 9) to determine if wiring harness is unserviceable.

LIGHTING SYSTEM CIRCUIT—Continued (Figure 2-32)

Malfunction	Circuit	Test
One or more trailer lights out (trailer receptacle inoperative).	21, 22, 23, 24, 22-460, 22-461, 90	Test 6. Perform trailer connector voltage test. Turn lighting switch to position which should light trailer lamp. Connect voltmeter as shown in figure 2-32, test 6, to appropriate connector socket of inoperative circuit. If 24 to 28 volts is indicated at correct connector socket, check the No. 90 wire ground connection. If No. 90 wire is tightly grounded, trailer electrical system is faulty. If no reading is indicated at correct connector socket, perform toeboard connector voltage test (test 7 below).
All or some of front or rear lamps inoperative (this test is to determine if cause of failure is lighting switch or wiring harness).	Rear: 21, 22, 23, 24, 22-460, 22-461, 75 Front: 17, 18, 19, 20, 460, 461, 491, 91, 92	Test 7. Perform toeboard connector voltage test. Remove front or rear toeboard connector (depending on where the defective lights are located) and inspect for corrosion, loose or dirty connections. Connect the voltmeter as shown in figure 2-32, test 7, to the connector pin or socket which corresponds to the defective circuit. Operate the light switch to the position which should light the faulty circuit. If 24 to 28 volts is indicated, the harness from the switch to the toeboard connector is in good condition. Inspect the harness from the toeboard connector to the individual light for breaks or loose connections. However, if no voltage reading is obtained for this test, perform light switch voltage test (test 9). If the stoplight circuit is faulty, perform stoplight switch test (test 8) and refer to the directional signal tests (figs. 2-34 to 2-38).


FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
(M656 SHOWN)
B. O. DRIVE LIGHT
LIGHT SWITCH
REAR COMPOSITE LIGHT
FRONT COMPOSITE LIGHT
92
20
460
491
20
RH
FRONT COMPOSITE LIGHT
DC
50 VOLT RANGE
B.O. DRIVE POSITION
UNLOCK
LOCK
B.O. DRIVE LIGHT
19
91
20
92
491
461
20
LH
FRONT COMPOSITE LIGHT
22-460
24
23
21
24
RH
REAR COMPOSITE LIGHT
DC
50 VOLT RANGE
VEHICLE FRAME
MUST BE IN POSITION FOR LAMPS BEING TESTED
22-461
24
23
21
24
LH
REAR COMPOSITE LIGHT
AT 12554

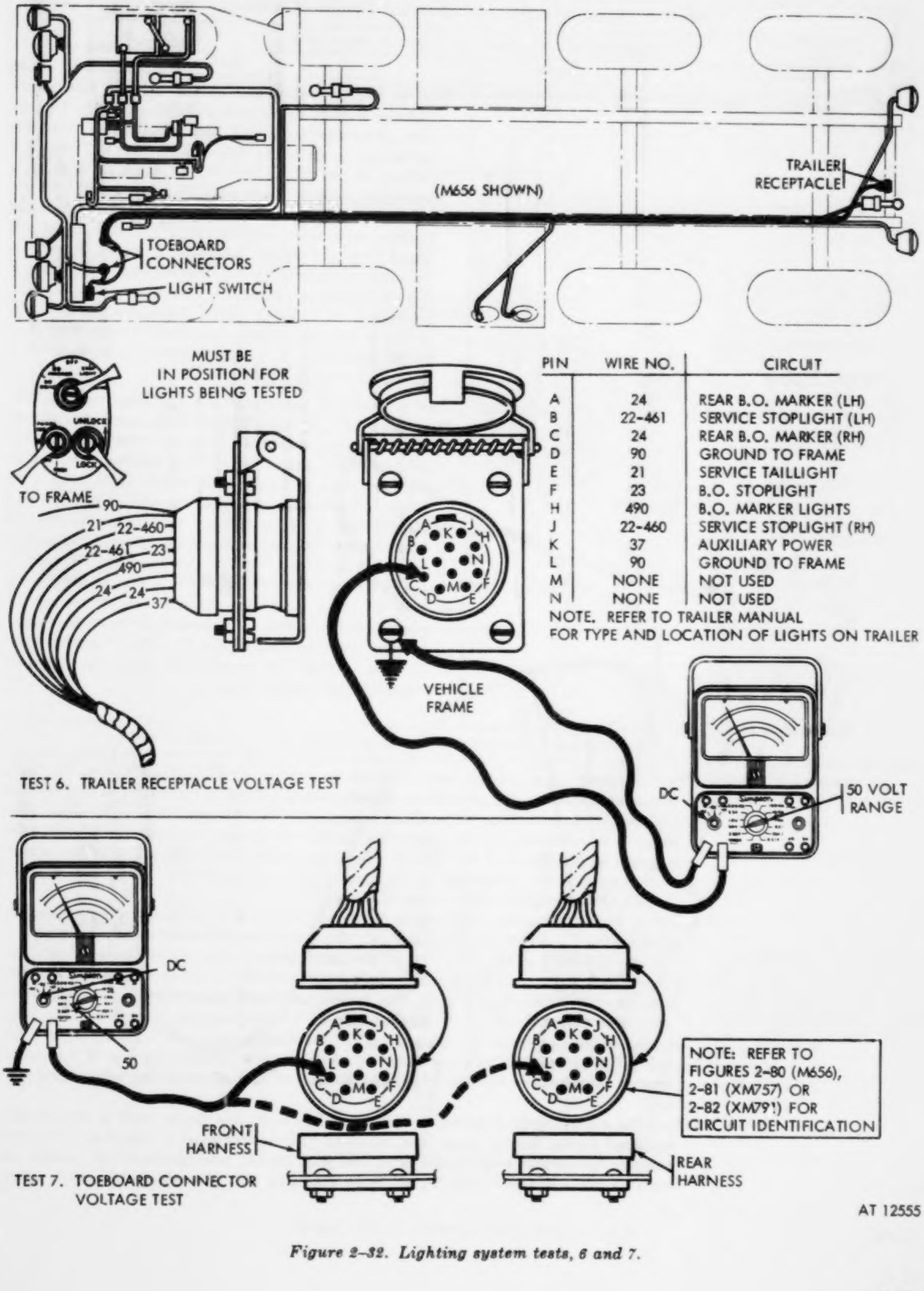
WIRE NO.	CIRCUIT
19	B.O. DRIVE
20	B.O. MARKER
91-92	GROUND

TEST 4. FRONT BLACKOUT LAMP CONNECTOR VOLTAGE TEST

WIRE NO.	CIRCUIT
21	SERVICE TAIL LIGHT
22-460	SERVICE STOPLIGHT - RIGHT
22-461	SERVICE STOPLIGHT - LEFT
23	B.O. STOPLIGHT
24	B.O. REAR MARKER

TEST 5. REAR LAMP CONNECTOR VOLTAGE TEST

Figure 2-31. Lighting system tests, 4 and 5.


TRAILER RECEPTACLE
(M656 SHOWN)
TOEBOARD CONNECTORS
LIGHT SWITCH
MUST BE IN POSITION FOR LIGHTS BEING TESTED
UNLOCK
LOCK
TO FRAME
90
21
22-460
22-461
23
490
24
24
37
A
B
C
D
E
F
H
J
K
L
M
N
VEHICLE FRAME
DC
50 VOLT RANGE
TEST 6. TRAILER RECEPTACLE VOLTAGE TEST
DC
50
FRONT HARNESS
REAR HARNESS
TEST 7. TOEBOARD CONNECTOR VOLTAGE TEST
AT 12555

PIN	WIRE NO.	CIRCUIT
A	24	REAR B.O. MARKER (LH)
B	22-461	SERVICE STOPLIGHT (LH)
C	24	REAR B.O. MARKER (RH)
D	90	GROUND TO FRAME
E	21	SERVICE TAILLIGHT
F	23	B.O. STOPLIGHT
H	490	B.O. MARKER LIGHTS
J	22-460	SERVICE STOPLIGHT (RH)
K	37	AUXILIARY POWER
L	90	GROUND TO FRAME
M	NONE	NOT USED
N	NONE	NOT USED

NOTE. REFER TO TRAILER MANUAL FOR TYPE AND LOCATION OF LIGHTS ON TRAILER

NOTE: REFER TO FIGURES 2-80 (M656), 2-81 (XM757) OR 2-82 (XM791) FOR CIRCUIT IDENTIFICATION

Figure 2-32. Lighting system tests, 6 and 7.

Table 2-5. Troubleshooting the Electrical System—Continued

LIGHTING SYSTEM CIRCUIT—Continued (Figure 2-33)

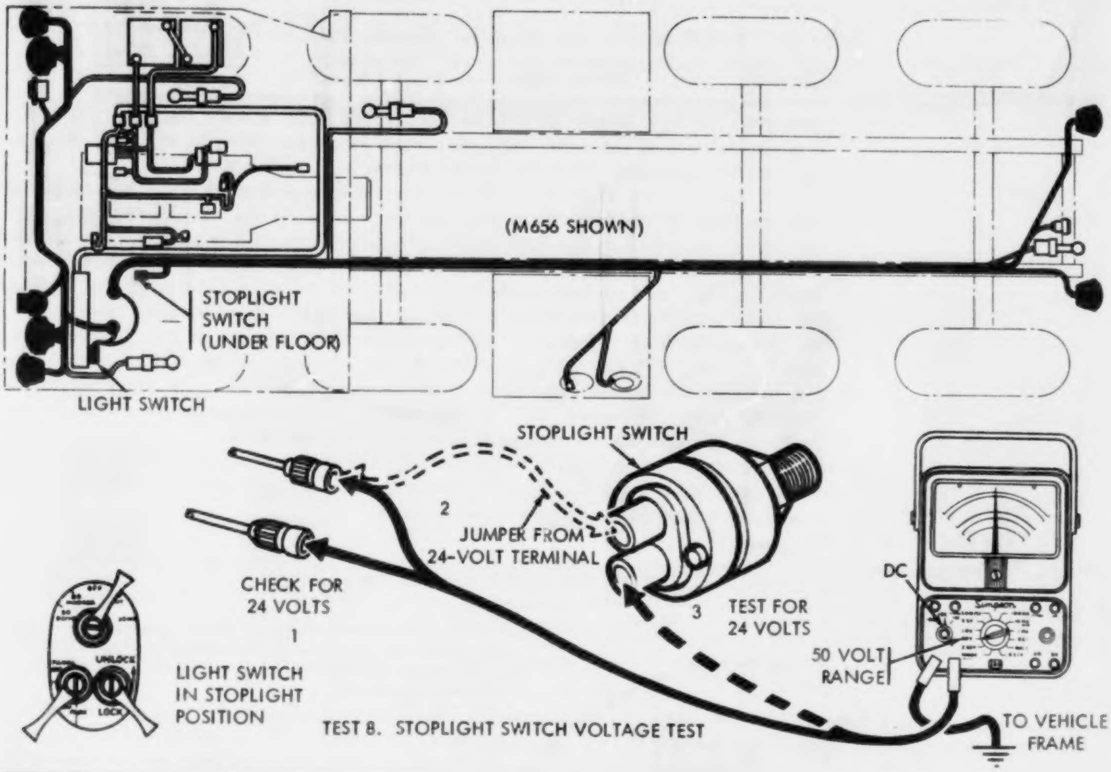
Malfunction	Circuit	Test
Stoplight inoperative (stoplight switch test).	75	Test 8. Perform stoplight switch voltage test. Move lighting switch to "STOPLIGHT" position. Disconnect connector from the stoplight switch. Connect voltmeter as shown in figure 2-33, test 8. Check for voltage at one of the two No. 75 wires. If voltage is indicated, connect that wire to one terminal of the stoplight switch. With brake pedal depressed, use positive voltmeter lead to check for voltage at exposed stoplight switch terminal. If 24 to 28 volts is indicated, stoplight switch is serviceable. If no reading is indicated, stoplight switch is faulty. If no reading is indicated at either of the two No. 75 wires, perform lighting switch connector voltage test (test 9) to determine if wiring harness is broken, or if lighting switch is unserviceable.
Lamps will not light (some lamps will not light).	15, 16, 19, 20, 21. 22, 23, 40, 75, 460, 461	Test 9. Perform lighting switch connector voltage test. Remove lighting switch from dash panel and disconnect harness connector. Connect voltmeter between vehicle frame and socket "F" of lighting switch harness as shown in figure 2-33, test 9. If 24 to 28 volts is not indicated, check wiring harness circuits Nos. 6, 450, 10 and 15 from battery to lighting switch for broken wires or loose connections. If 24 to 28 volts is indicated on socket "F" of the connector, connect a jumper wire from "F" socket to socket of faulty circuit. If lamps light with jumper wire connected, replace lighting switch. If some lamps do not light with jumper wire connected, check wiring harness from lighting switch to inoperative light or toeboard connector for broken wires.

DIRECTIONAL SIGNAL SYSTEM CIRCUIT (Figure 2-34)

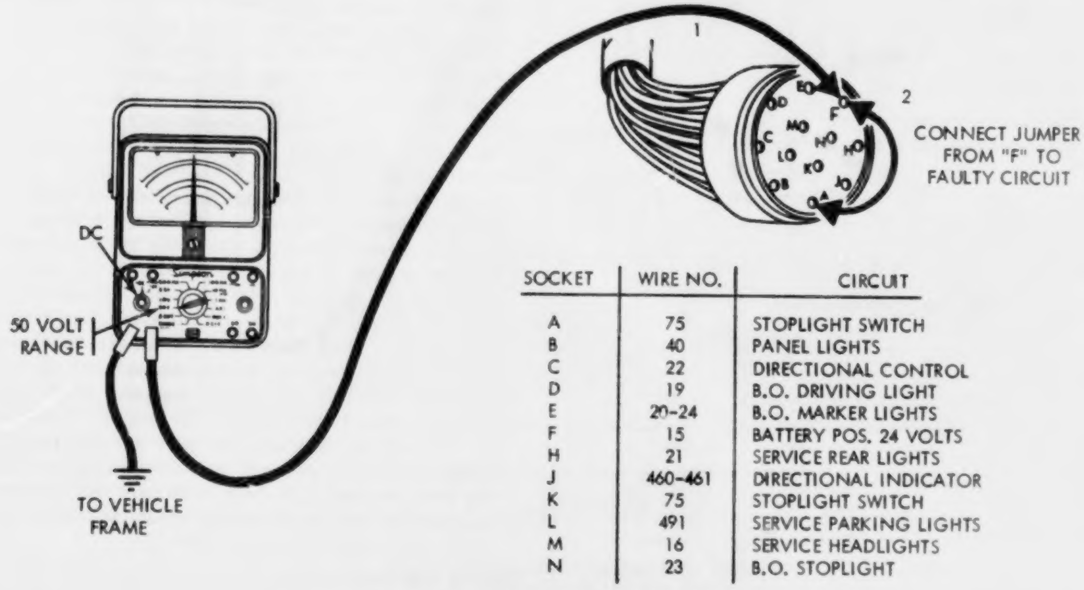
DESCRIPTION: The directional signal system uses a solid state (transistorized) flasher unit. The basic components consist of a directional signal control assembly (mounted on the steering column), a flasher unit, connecting cables, and four lamps. The individual front lamps are contained in the composite park, turn, and blackout light assemblies mounted at the front of the vehicle. The rear lamps are combined with the service stoplights and are contained in two composite tail, stoplight park and blackout marker light assemblies at the rear of the vehicle.

Refer to and follow figure 2-34 wiring diagram. The system is energized by setting the light switch to "STOPLIGHT" position, which supplies 24 volts from its terminal "J" via wire 460-461 to terminal "G" of the directional signal control unit. Moving the control unit lever to indicate a turn connects terminal "G" to terminal "F" and supplies 24 volts to the flasher unit. The flasher unit contains electronic circuitry which interrupts this 24 volts at a regular rate of 1/2 to 1-second intervals. This interrupted voltage appears at terminal "A" of the flasher unit and is returned to terminal "H" of the control unit via wire "A". An indicator lamp in the end of the control lever is connected to terminal "H" and flashes on and off with the interrupted voltage.

When the control lever is moved to indicate a left turn, the flasher unit is energized as described above. At the same time terminal "H" is connected to terminal "C" which connects to the left turn signal lamp via wire 22-461 and terminal "B" which connects to the left front turn signal lamp via wire 461. The stoplight switch circuit


(M656 SHOWN)
STOPLIGHT SWITCH (UNDER FLOOR)
LIGHT SWITCH
STOPLIGHT SWITCH
2
JUMPER FROM 24-VOLT TERMINAL
CHECK FOR 24 VOLTS
1
3
TEST FOR 24 VOLTS
DC
50 VOLT RANGE
LIGHT SWITCH IN STOPLIGHT POSITION
TO VEHICLE FRAME
UNLOCK
LOCK

TEST 8. STOPLIGHT SWITCH VOLTAGE TEST


1
2
CONNECT JUMPER FROM "F" TO FAULTY CIRCUIT
DC
50 VOLT RANGE
TO VEHICLE FRAME
A
B
C
D
E
F
H
J
K
L
M

SOCKET	WIRE NO.	CIRCUIT
A	75	STOPLIGHT SWITCH
B	40	PANEL LIGHTS
C	22	DIRECTIONAL CONTROL
D	19	B.O. DRIVING LIGHT
E	20-24	B.O. MARKER LIGHTS
F	15	BATTERY POS. 24 VOLTS
H	21	SERVICE REAR LIGHTS
J	460-461	DIRECTIONAL INDICATOR
K	75	STOPLIGHT SWITCH
L	491	SERVICE PARKING LIGHTS
M	16	SERVICE HEADLIGHTS
N	23	B.O. STOPLIGHT

TEST 9. LIGHT SWITCH CONNECTOR VOLTAGE TEST

AT 12556

Figure 2-33. Lighting system, tests 8 and 9.

Table 2-5. Troubleshooting the Electrical System—Continued

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-34)

(terminal "D") is disconnected from the left stoplight circuit (terminal "C") and is connected only to the right stoplight circuit (terminal "E"), so the right stoplight will function normally when the service brakes are applied.

When the control lever is moved to indicate a right turn, the same action occurs, except that terminal "E" is connected to the right rear stoplight via wire 22-460, and terminal "A" is connected to the right front turn signal lamp via wire 460. The stoplight switch circuit (terminal "D") is now disconnected from the right stoplight circuit (terminal "E") and connected only to the left stoplight circuit (terminal "C"), so the left stoplight will function normally when the service brakes are applied.

When the control lever is moved to the hazard warning position, all four lights (terminals "A", "B", "C", and "E") are connected to terminal "H" so that all turn indicator lights on the vehicle (and trailer) will flash simultaneously. In this position, the stoplight switch (terminal "D") is disconnected completely, since the vehicle is normally not driven with the hazard warning lights in operation.

An overall test of the system is to perform all functions of the directional signal control switch and observe the action of the lights as described above. Figure 2-34 shows a wiring diagram of the complete system circuit.

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-35)

Malfunction	Circuit	Test
		Note. **Before starting tests, make a thorough visual inspection for loose connections, poor ground, or frayed cables. Make all necessary repairs before proceeding.**
Individual lamps do not light with directional signal control lever in any position.	460, 461, 22-460, 22-461	**Test 1. Perform lamp continuity test. Set main light switch to "STOPLIGHT" position. Try all positions of directional signal control lever, and observe which lights do not light in any position of the lever. Have assistant depress brake pedal and observe stoplights. If stoplights light, rear lamps are operational. If stoplights do not light, or if front turn indicators do not light in any position of the control lever, turn light switch to "OFF" and disconnect connector 460, 461, 22-460 or 22-461, corresponding to defective light (fig. 2-35). Set up multimeter for continuity test (see fig. 2-12). Clip black test lead to vehicle frame. Touch red lead to connector on light, as shown in figure 2-35, test 1. If the meter needle deflects to approximately 5 ohms, the lamp is normal and the trouble is elsewhere. If the meter does not deflect at all (infinity reading) replace lamp and retest. If meter still shows infinity or considerably more than 5 ohms, touch red test lead to the frame ground, making sure to scrape through the paint to the bare metal. If the meter does not deflect completely to zero ohms, inspect the ground connection on wire 92, by removing the wire and scraping all metal surfaces bright, and reconnecting. When light has been restored to 5 ohms, reconnect the connector and test the directional system again. If trouble still exists, perform wire harness tests.** **Test 2. Perform wiring harness voltage test. Set up multimeter for dc voltage tests (see fig. 2-9). Disconnect connectors 460, 461, 22-460 or 22-461, corresponding to defective light (fig. 2-35). Set main light**

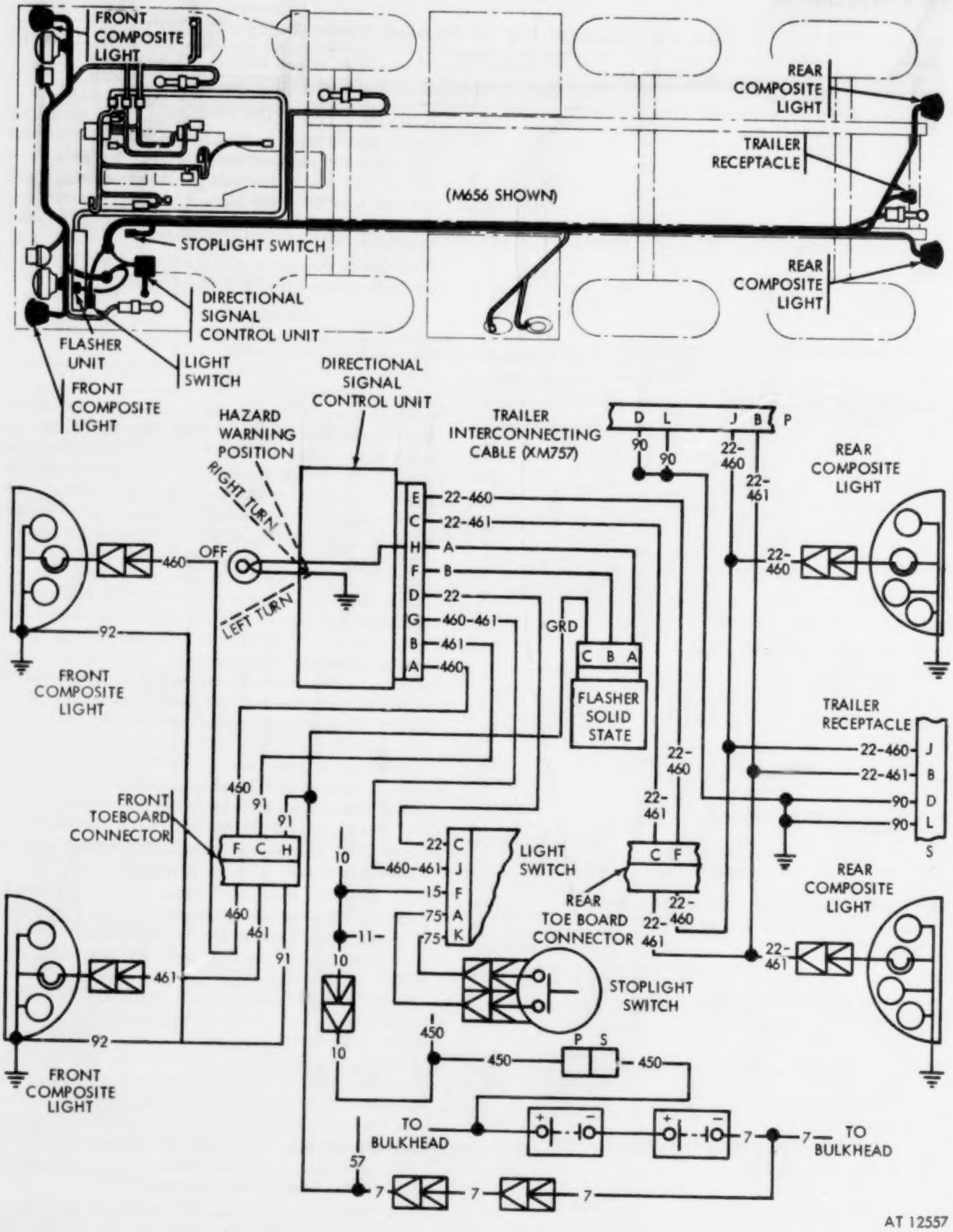

FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
TRAILER RECEPTACLE
(M656 SHOWN)
STOPLIGHT SWITCH
REAR COMPOSITE LIGHT
DIRECTIONAL SIGNAL CONTROL UNIT
FLASHER UNIT
LIGHT SWITCH
FRONT COMPOSITE LIGHT
DIRECTIONAL SIGNAL CONTROL UNIT
HAZARD WARNING POSITION
RIGHT TURN
OFF
LEFT TURN
TRAILER INTERCONNECTING CABLE (XM757)
D L J B P
90
90
22-460
22-461
REAR COMPOSITE LIGHT
E C H F D G B A
22-460
22-461
A
B
22
460-461
461
460
GRD
C B A
FLASHER SOLID STATE
460
92
FRONT COMPOSITE LIGHT
TRAILER RECEPTACLE
22-460 J
22-461 B
90 D
90 L
S
FRONT TOEBOARD CONNECTOR
F C H
460
91
91
22 C
460-461 J
15 F
75 A
75 K
LIGHT SWITCH
10
11
REAR TOE BOARD CONNECTOR
C F
22-460
22-461
REAR COMPOSITE LIGHT
22-461
461
92
FRONT COMPOSITE LIGHT
STOPLIGHT SWITCH
450
P S
450
TO BULKHEAD
57
7
TO BULKHEAD
AT 12557

Figure 2-34. Directional signal, parking and stoplight circuit wiring diagram.

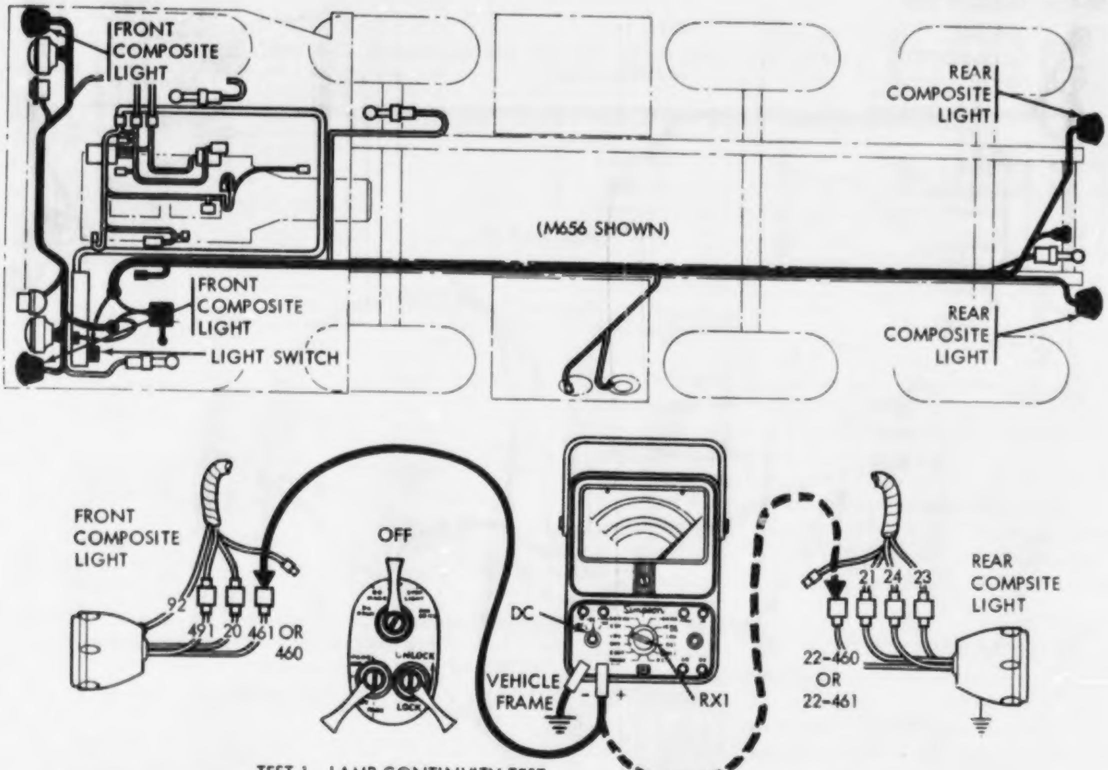
Table 2-5. Troubleshooting the Electrical System—Continued

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-35)

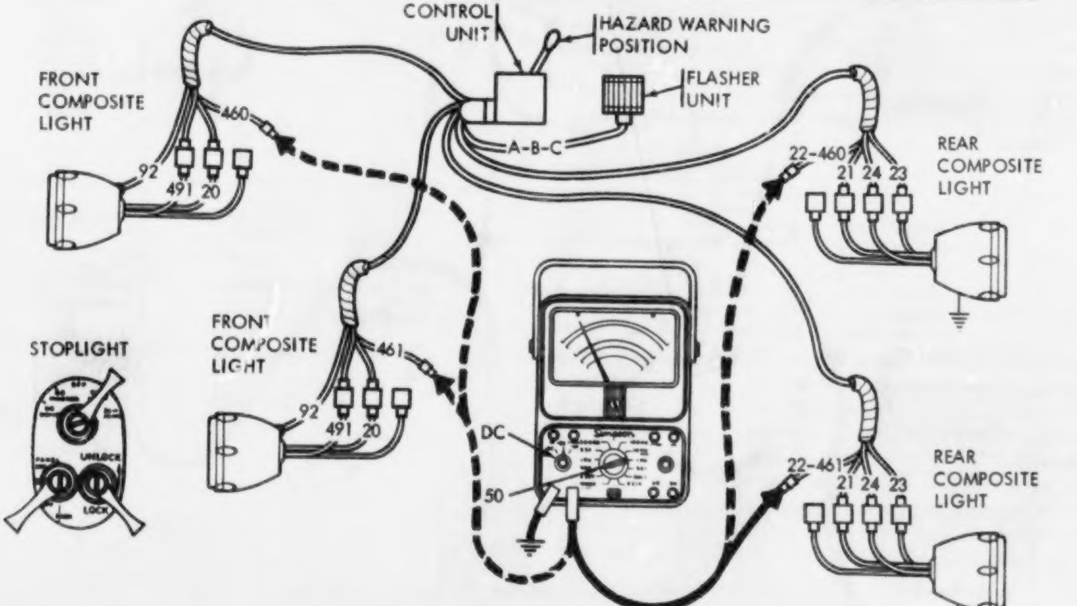
Malfunction	Circuit	Test
		switch to "STOPLIGHT" position, and directional signal control lever to "HAZARD WARNING" position. Connect multimeter as shown in figure 2-35, test 2. Clip black test lead to vehicle frame. Touch red test lead to center contact of cable connector on wiring harness. The voltmeter needle should deflect at a rate of 1 to 2 per second. If meter does not deflect, leave connector disconnected from light and perform wiring harness continuity test.

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-36)

Malfunction	Circuit	Test
		Test 3. Perform wiring harness continuity test. Set up multimeter for continuity test (see fig. 2-12). Set main light switch to "OFF". Connect the black test lead to the vehicle frame near the control unit. Remove the cable connector from the control unit. Touch the red test lead to a socket in the cable connector to correspond with the defective circuit. The meter needle should not deflect (infinite reading). If there is any deflection, the wiring harness has a short circuit, or a high resistance leakage. Inspect the harness for frayed or pinched cables, and make repairs. If infinity is indicated on the meter, connect a jumper wire from the vehicle frame to the cable connector at the lights, as shown in figure 2-36, test 3. Touch the red test lead to the appropriate socket terminal in the cable connector at the control unit. The meter needle should deflect fully showing zero ohms. If less than full deflection, inspect the wiring harness for breaks, frayed wires, corroded connections, etc., and make necessary repairs. When all lamps and wiring harness have continuity restored, and system still does not operate, perform flasher and control unit tests.
No lights operate with directional signal control lever in any position.	460, 461	Test 4. Perform directional signal control unit voltage feed test. Set up the multimeter for dc voltage test (see fig. 2-9). Remove the cable connector from the directional signal control unit. Set the main light switch to "STOPLIGHT" position. Measure the voltage from the vehicle frame to terminal "G" of the cable connector on the wiring harness, as shown in figure 2-36, test 4. The meter needle should indicate 24 volts. If less or none, remove the cable connector from the light switch and perform a continuity test. If continuity is satisfactory, the light switch is defective (refer to fig. 2-31). When 24 volts has been restored to contact "G" of the directional control unit cable connector, and the system still does not operate, perform the flasher cable continuity test. Test 5. Perform wiring harness continuity test. Set up multimeter for continuity tests (see fig. 2-12). Con-


FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
(M656 SHOWN)
FRONT COMPOSITE LIGHT
LIGHT SWITCH
REAR COMPOSITE LIGHT
FRONT COMPOSITE LIGHT
92
491
20
461 OR 460
OFF
DC
VEHICLE FRAME
-
+
RX1
21
24
23
REAR COMPSITE LIGHT
22-460 OR 22-461

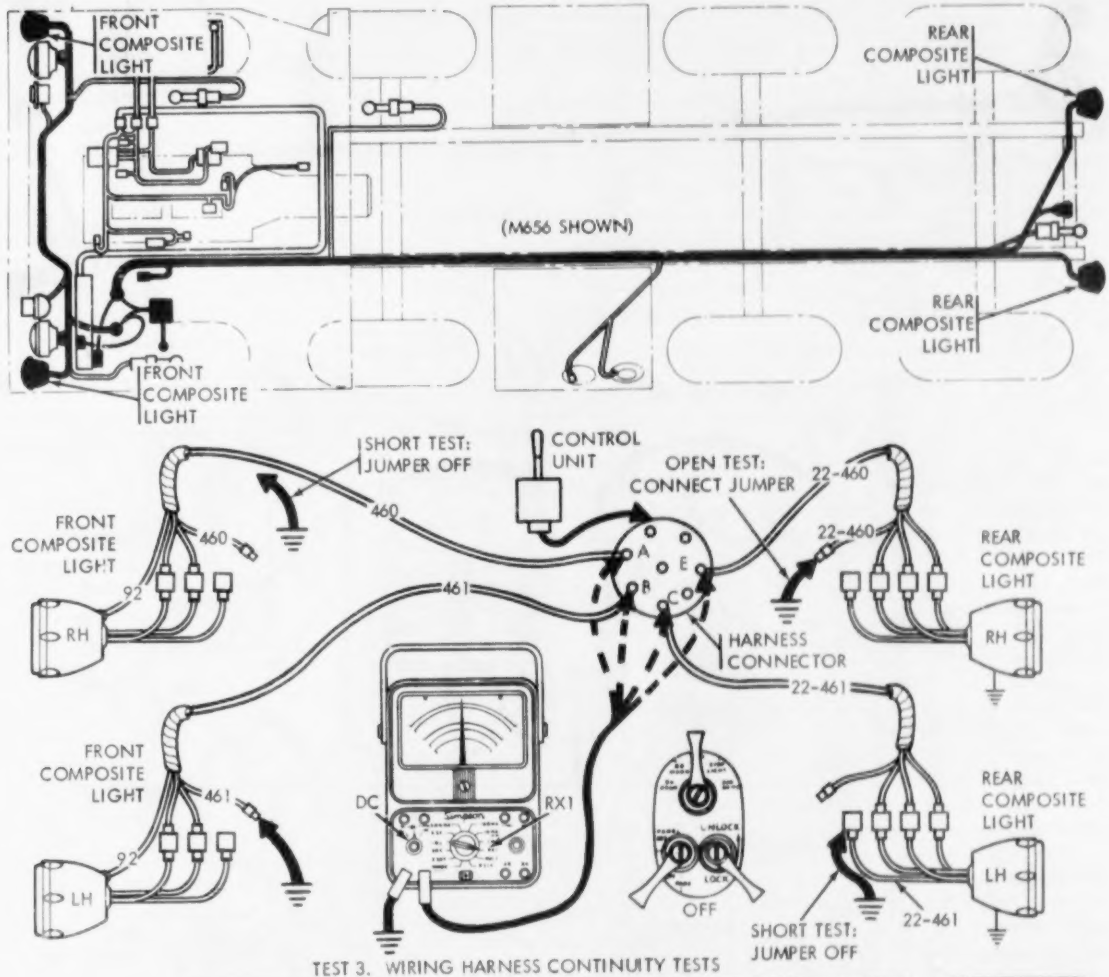
TEST 1. LAMP CONTINUITY TEST


CONTROL UNIT
HAZARD WARNING POSITION
FLASHER UNIT
FRONT COMPOSITE LIGHT
460
92
491
20
A-B-C
22-460
21
24
23
REAR COMPOSITE LIGHT
STOPLIGHT
FRONT COMPOSITE LIGHT
461
92
491
20
DC
50
22-461
21
24
23
REAR COMPOSITE LIGHT

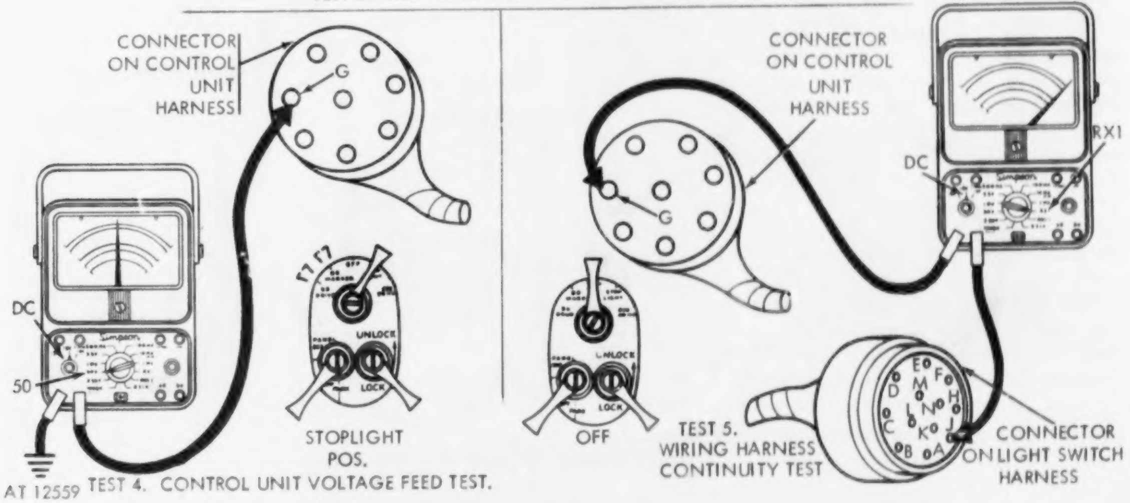
TEST 2. WIRING HARNESS VOLTAGE TESTS

AT 12558

Figure 2-35. Directional signal system tests, 1 and 2.


FRONT COMPOSITE LIGHT
REAR COMPOSITE LIGHT
(M656 SHOWN)
REAR COMPOSITE LIGHT
FRONT COMPOSITE LIGHT
SHORT TEST: JUMPER OFF
CONTROL UNIT
OPEN TEST: CONNECT JUMPER
22-460
460
22-460
FRONT COMPOSITE LIGHT
460
A
E
B
C
REAR COMPOSITE LIGHT
92
RH
461
HARNESS CONNECTOR
RH
22-461
FRONT COMPOSITE LIGHT
461
DC
RX1
REAR COMPOSITE LIGHT
92
LH
OFF
LH
SHORT TEST: JUMPER OFF
22-461

TEST 3. WIRING HARNESS CONTINUITY TESTS


CONNECTOR ON CONTROL UNIT HARNESS
G
DC
50
STOPLIGHT POS.
CONNECTOR ON CONTROL UNIT HARNESS
G
DC
RX1
OFF
E
F
D
M
H
L
N
C
K
J
B
A
CONNECTOR ON LIGHT SWITCH HARNESS

AT 12559 TEST 4. CONTROL UNIT VOLTAGE FEED TEST.

TEST 5. WIRING HARNESS CONTINUITY TEST

Figure 2-36. Directional signal system tests 3, 4 and 5.

Table 2-5. Troubleshooting the Electrical System—Continued

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-36)

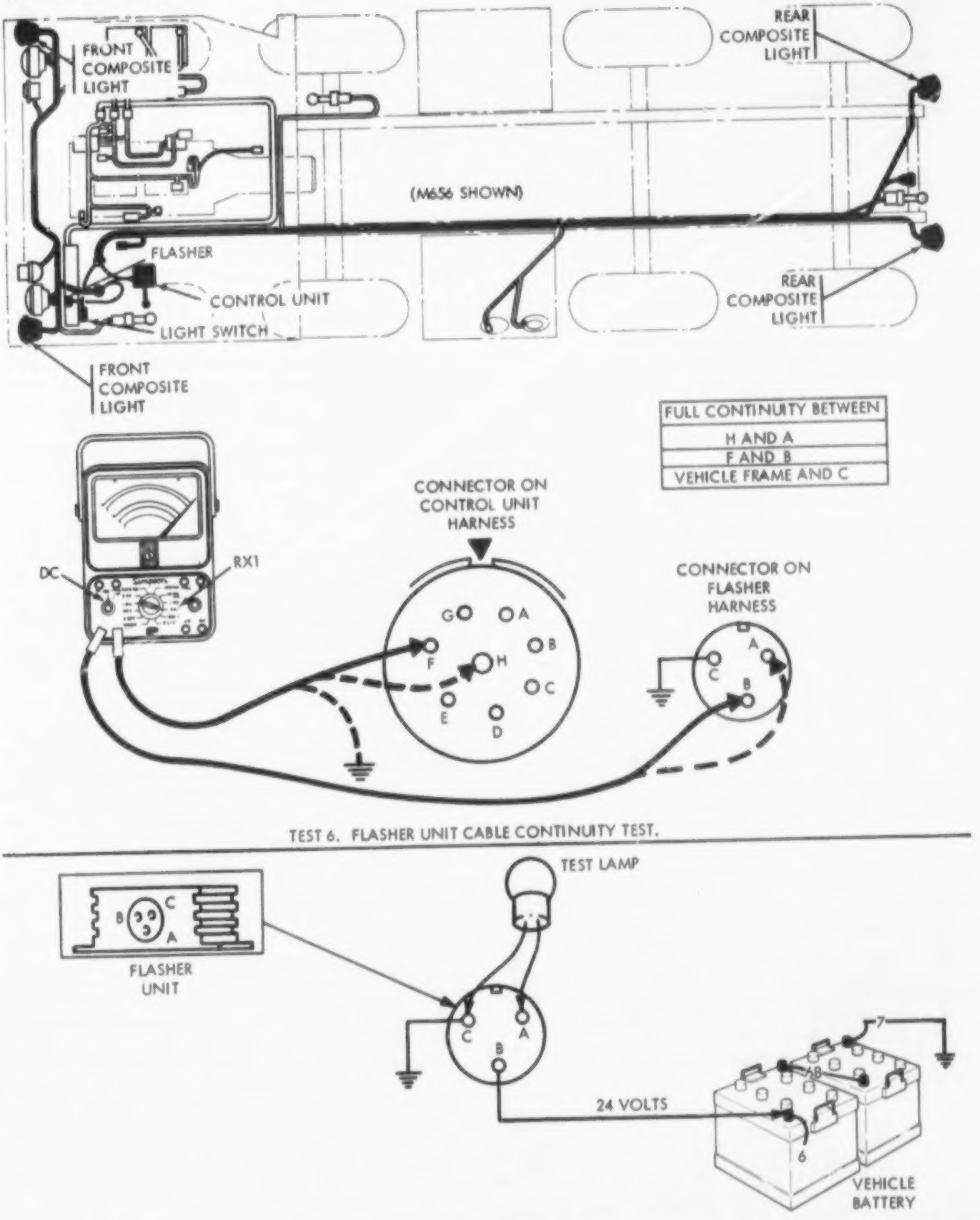
Malfunction	Circuit	Test
		nect test leads between contact "G" on the control unit end and contact "J" at the light switch end, as shown in figure 2-36, taet 5.

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-37)

Malfunction	Circuit	Test
	A, B, C	Test 6. Flasher unit cable continuity test. Set up the multimeter for continuity. (See fig. 2-12). Remove the cable connector from the flasher unit. Remove the cable connector from the control unit. Measure continuity between the cable wires as shown in figure 2-37, test 6. If any wire does not have continuity, inspect and make necessary repairs. If all three wires show continuity, perform the flasher operational test.
Flashes erratically, no flash, or very slow flash.	A, B, C	*Note.* It may be necessary to remove the flasher from the vehicle to make the following test. Test 7. Perform the flasher operational test. Disconnect the cable connector from the flasher. Connect a source of positive 24 volts to terminal "B" of the flasher socket. (If the voltage is inadvertently reversed to the flasher, it will not operate. However, the flasher will not be harmed, due to built-in reversal protection.) Connect one lamp type MS-35478-1683 between contact "A" and "C". Connect contact "C" to negative 24 volts, as shown in figure 2-37, test 7. The flasher should flash at a rate of 60 to 120 flashes per minute, at a regular rate without skipping. If it does not flash, or flashes irregularly, replace the flasher unit. If the flasher tests satisfactory, perform control unit bench test.

DIRECTIONAL SIGNAL SYSTEM CIRCUIT—Continued (Figure 2-38)

Malfunction	Circuit	Test
System operates incorrectly in one or more positions of the directional signal control lever (all lights and wiring harness test satisfactory).	22, 22-460, 22-461, 460, 461, 75	*Note.* It may be necessary to remove the directional signal control unit from the vehicle to perform the following test. Test 8. Perform the directional signal control unit continuity test. Set up the multimeter for continuity tests (see fig. 2-12). Remove the cable connector from the control unit, and if necessary, remove the control unit from the vehicle. Remove the indicator lamp from the control arm. Set the control lever in each of the four operating positions and make tests as shown in figure 2-38, test 8. If any circuit does not test as shown in the tables, replace the control unit.

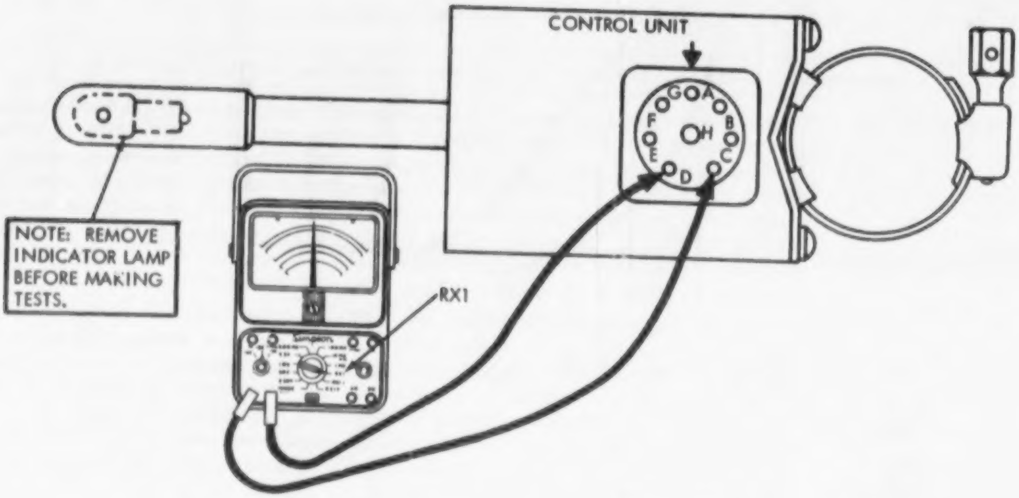

FRONT
COMPOSITE
LIGHT
(M656 SHOWN)
REAR
COMPOSITE
LIGHT
FLASHER
CONTROL UNIT
LIGHT SWITCH
REAR
COMPOSITE
LIGHT
FRONT
COMPOSITE
LIGHT
DC
RX1
Simpson
CONNECTOR ON
CONTROL UNIT
HARNESS
G
A
B
F
H
C
E
D
CONNECTOR ON
FLASHER
HARNESS
A
C
B
TEST LAMP
B
C
A
FLASHER
UNIT
C
A
B
24 VOLTS
7
68
6
VEHICLE
BATTERY
AT 12560

FULL CONTINUITY BETWEEN
H AND A
F AND B
VEHICLE FRAME AND C

TEST 6. FLASHER UNIT CABLE CONTINUITY TEST.

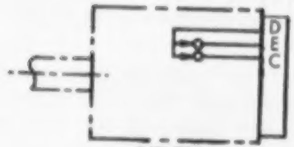
TEST 7. FLASHER OPERATIONAL TEST

Figure 2-37. Directional signal system tests, 6 and 7.



NOTE: REMOVE INDICATOR LAMP BEFORE MAKING TESTS.

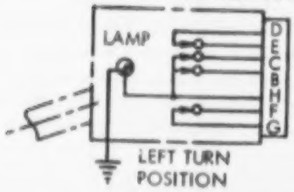
SCHEMATIC DIAGRAM



NEUTRAL POSITION

FROM PIN:	TO PIN:	INDICATION
H	A	OPEN
H	B	OPEN
H	C	OPEN
H	E	OPEN
D	C	SHORTED
D	E	SHORTED
F	G	OPEN

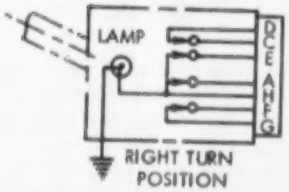
A. DIRECTIONAL SIGNAL CONTROL LEVER IN "NEUTRAL" POSITION



LEFT TURN POSITION

FROM PIN:	TO PIN:	INDICATION
H	B	SHORTED
H	C	SHORTED
H	A	OPEN
H	E	OPEN
F	G	SHORTED
D	E	SHORTED
D	C	OPEN

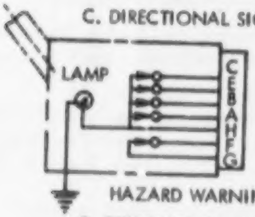
B. DIRECTIONAL SIGNAL CONTROL LEVER IN "LEFT TURN" POSITION



RIGHT TURN POSITION

FROM PIN:	TO PIN:	INDICATION
F	G	SHORTED
H	A	SHORTED
H	E	SHORTED
H	B	OPEN
H	C	OPEN
D	C	SHORTED
D	E	OPEN

C. DIRECTIONAL SIGNAL CONTROL LEVER IN "RIGHT TURN" POSITION



HAZARD WARNING POSITION

FROM PIN:	TO PIN:	INDICATION
H	A	SHORTED
H	B	SHORTED
H	C	SHORTED
H	E	SHORTED
D	E	OPEN
D	C	OPEN
F	G	SHORTED

D. DIRECTIONAL SIGNAL CONTROL LEVER IN "HAZARD WARNING" POSITION

TEST 8. DIRECTIONAL SIGNAL CONTROL UNIT CONTINUITY TESTS.

AT 12561

Figure 2–38. Directional signal system test 8.

Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS (Figures 2-39, 2-40 and 2-41)

DESCRIPTION: The electrical components mounted in the instrument panel consist of the battery-generator indicator, fuel level gage, temperature indicator, oil pressure indicator, headlight beam indicator and panel lights. Three non-electrical components, the speedometer, tachometer and air pressure gages, are also mounted on the instrument panel. The entire group makes up the instrument cluster. The transmission overheat warning light is mounted in the engine control panel at the right of the instrument cluster. The horn is mounted at the right front of the cab, and the horn button is at the center of the steering wheel hub.

The fuel level gage is activated by the fuel level transmitter mounted in the top of the fuel tank. The XM757 truck (refer to fig. 2-40) is equipped with dual tanks and a switch (mounted on the dashboard under the instrument cluster) to select the right or left fuel tank, as required. A separate fuel level transmitter is mounted in each tank. The right or left transmitter is automatically connected to the fuel level gage by the fuel indicator transfer relay when the corresponding tank is selected. When the right hand tank is selected, the fuel return solenoid is also energized to return unused engine fuel to the right hand tank.

The oil pressure transmitter is located on the engine block above the starting motor. The water temperature transmitter is located in the side of the water manifold, directly above the alternator. The transmission overheat switch is located in an oil fitting on the right hand side of the transmission case.

The instrument cluster electrical components are energized by turning the master switch to "ON" position (Refer to and follow figure 2-39). This energizes circuit 27 from circuits 6, 450, 10 and 11. Circuit 27 goes through a circuit breaker and then through circuit 27A to the instrument cluster, where it supplies 24 volts battery voltage for the various instrument and gage circuits. The temperature indicator system starts at the engine block, through the temperature transmitter, via circuit 33 through the temperature indicator, to circuit 27A. The oil pressure system starts at the engine block, through the oil pressure transmitter, via circuit 36, through the oil pressure indicator, to circuit 27A. The fuel level indicator system on the M656 and XM791 trucks starts at the negative battery terminal, through circuit 7 and 79, through the fuel level transmitter, then via circuit 28 through the fuel level indicator, to circuit 27A. The fuel transmitter system for the XM757 truck is shown in figure 2-40.

The transmission overheat warning light circuit starts from the engine ground, through the transmission overheat switch, via wire circuit 327A through pin E of the toeboard connector, 327A to the warning lamp, and through the lamp via circuit 327 to join with circuit 27 to the master switch. Refer to figure 2-39.

The battery-generator indicator is connected from the instrument cluster common ground circuit 57 via circuit 27 to the master switch, thus putting it directly across the 24-volt battery supply to the instruments. The instrument panel lamps are connected from the instrument panel common ground via circuit 40 to the main light switch. The high beam indicator lamp is connected from the instrument panel common ground via circuit 17 to the high beam terminal of the dimmer switch.

The horn is energized via circuit 10 through a circuit breaker, via circuit 2 through the horn assembly, through the horn button, to circuit 57, then via circuit 7 to the negative battery terminal. Refer to figure 2-41.

A quick test for the instrument cluster is to operate the master switch to "ON" and observe that all instruments and gages are operational. The transmission overheat warning light cannot be tested easily as a routine check. Refer to figure 2-45, test 8, for a test procedure.

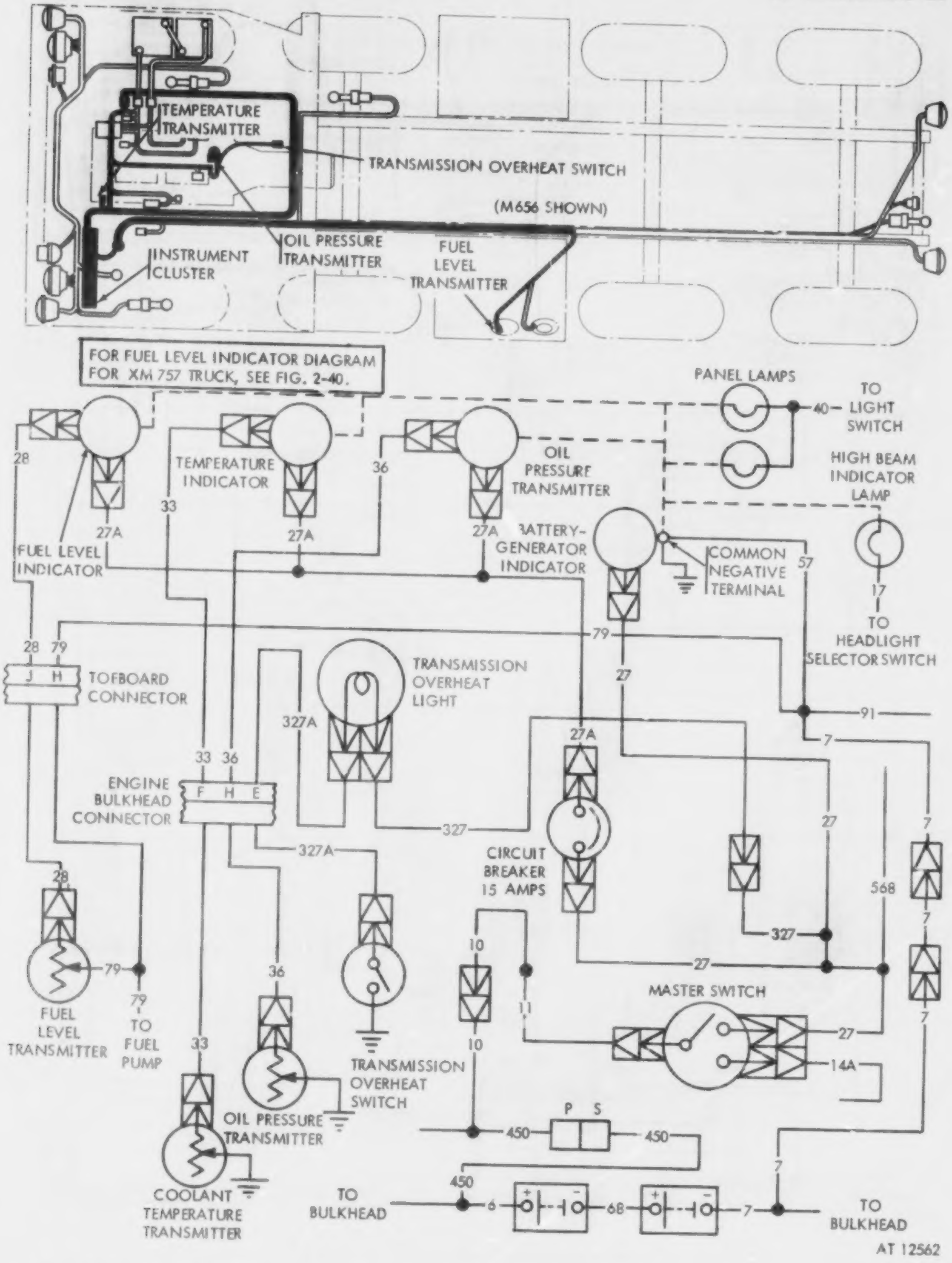
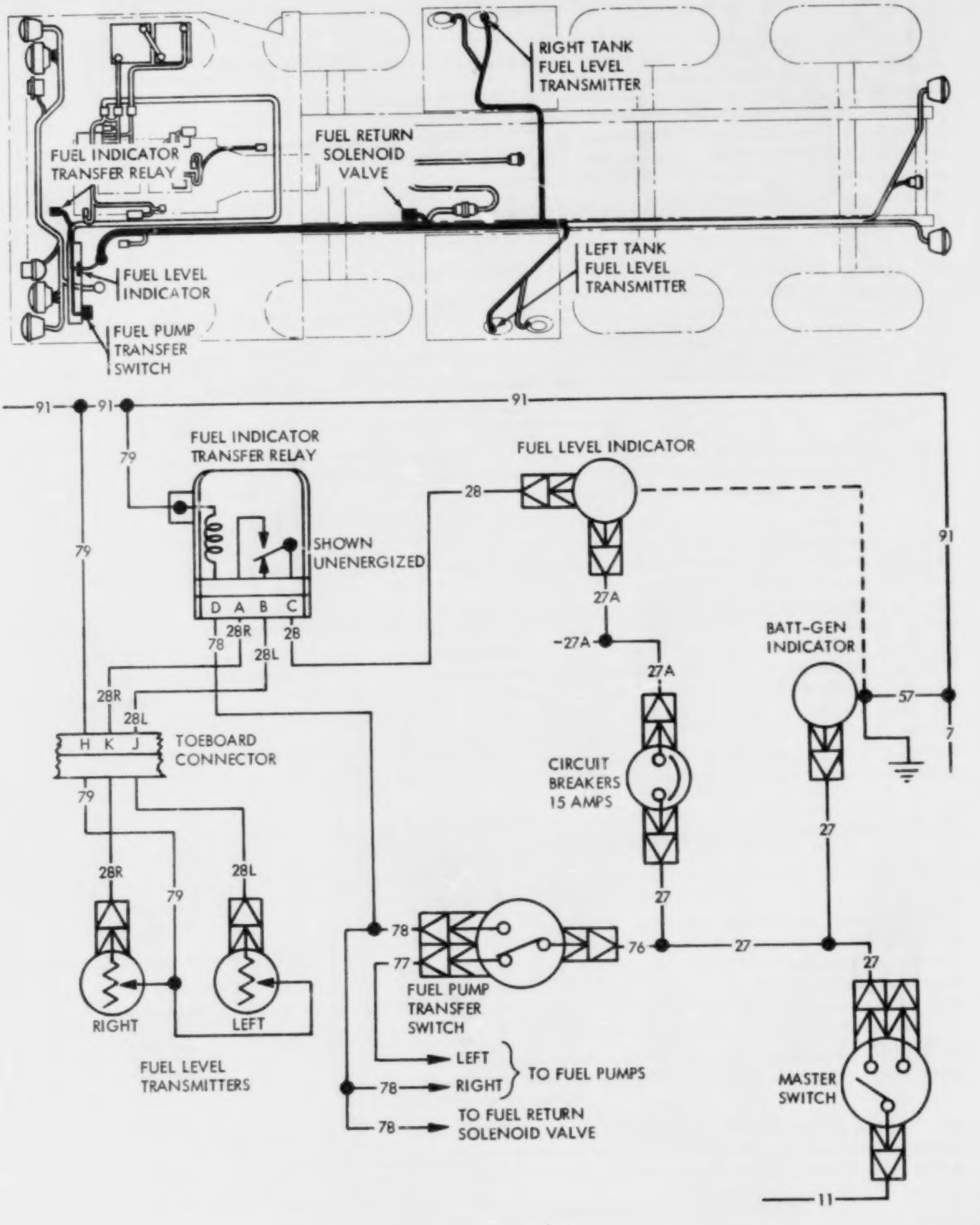

TEMPERATURE TRANSMITTER
TRANSMISSION OVERHEAT SWITCH
(M656 SHOWN)
OIL PRESSURE TRANSMITTER
INSTRUMENT CLUSTER
FUEL LEVEL TRANSMITTER
FOR FUEL LEVEL INDICATOR DIAGRAM FOR XM 757 TRUCK, SEE FIG. 2-40.
PANEL LAMPS
TO LIGHT SWITCH
40
HIGH BEAM INDICATOR LAMP
17
TO HEADLIGHT SELECTOR SWITCH
28
33
36
27A
TEMPERATURE INDICATOR
OIL PRESSURE TRANSMITTER
FUEL LEVEL INDICATOR
BATTERY-GENERATOR INDICATOR
COMMON NEGATIVE TERMINAL
57
79
27
91
7
TOEBOARD CONNECTOR
J H
TRANSMISSION OVERHEAT LIGHT
327A
327
ENGINE BULKHEAD CONNECTOR
F H E
CIRCUIT BREAKER 15 AMPS
568
10
11
MASTER SWITCH
14A
FUEL LEVEL TRANSMITTER
79 TO FUEL PUMP
TRANSMISSION OVERHEAT SWITCH
OIL PRESSURE TRANSMITTER
COOLANT TEMPERATURE TRANSMITTER
450
P S
TO BULKHEAD
6
68
TO BULKHEAD
AT 12562

Figure 2-39. Fuel level, temperature, oil pressure and battery-generator indicators wiring diagram.


RIGHT TANK
FUEL LEVEL
TRANSMITTER
FUEL RETURN
SOLENOID
VALVE
FUEL INDICATOR
TRANSFER RELAY
LEFT TANK
FUEL LEVEL
TRANSMITTER
FUEL LEVEL
INDICATOR
FUEL PUMP
TRANSFER
SWITCH
91
91
91
79
FUEL INDICATOR
TRANSFER RELAY
SHOWN
UNENERGIZED
D A B C
28R
78
28L
28
FUEL LEVEL INDICATOR
28
27A
27A
27A
91
BATT-GEN
INDICATOR
57
7
79
28R
28L
H K J
TOEBOARD
CONNECTOR
79
CIRCUIT
BREAKERS
15 AMPS
27
28R
79
28L
27
RIGHT
LEFT
FUEL LEVEL
TRANSMITTERS
78
77
FUEL PUMP
TRANSFER
SWITCH
76
27
27
LEFT
78
RIGHT
TO FUEL PUMPS
78
TO FUEL RETURN
SOLENOID VALVE
MASTER
SWITCH
11

AT 12563

Figure 2-40. Fuel level indicator circuit wiring diagram, XM757 truck.

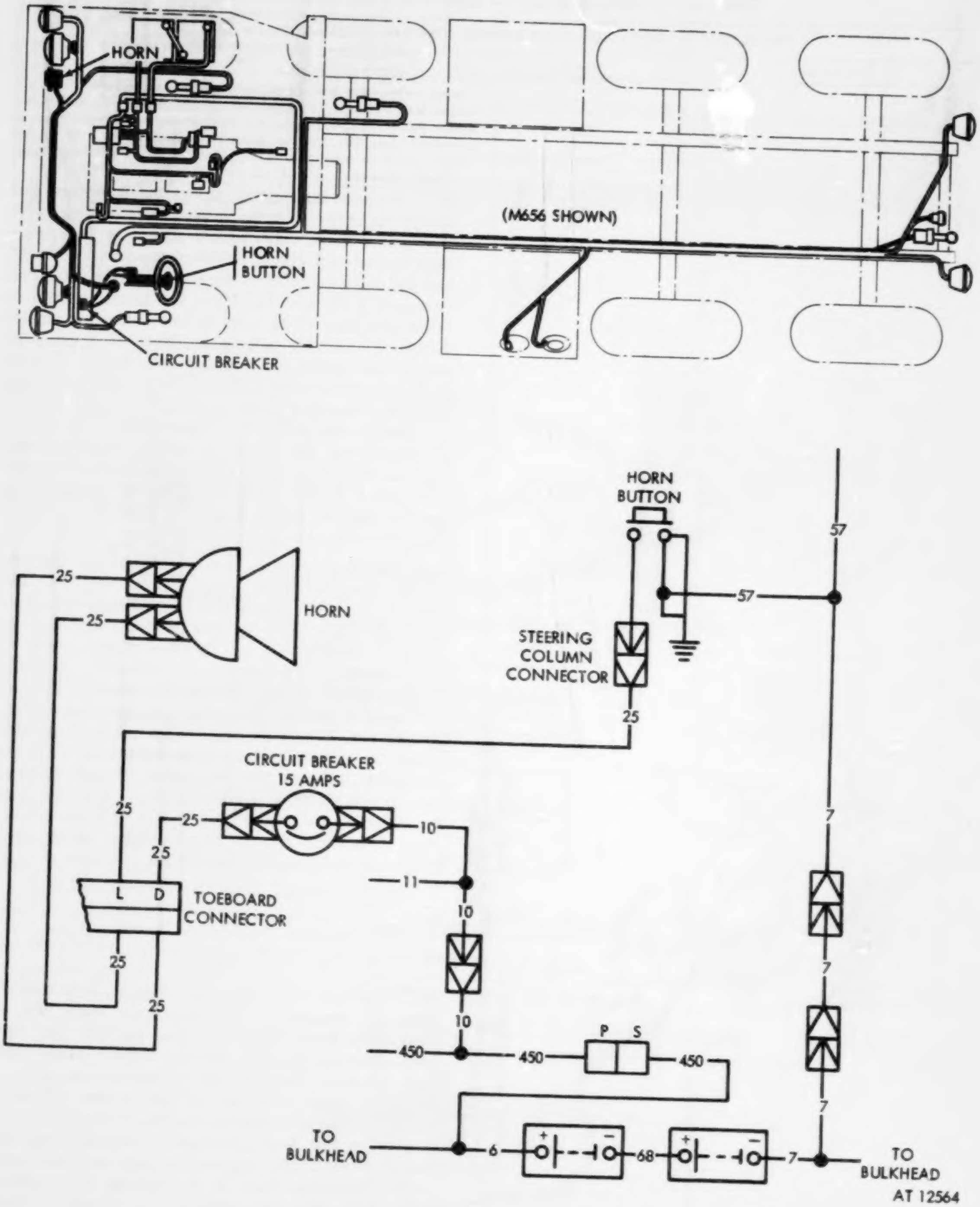

HORN
HORN BUTTON
CIRCUIT BREAKER
(M656 SHOWN)
HORN BUTTON
57
25
25
HORN
57
STEERING COLUMN CONNECTOR
25
CIRCUIT BREAKER 15 AMPS
25
25
10
25
7
11
L
D
TOEBOARD CONNECTOR
10
25
7
25
10
450
450
P
S
450
7
TO BULKHEAD
6
+
−
68
+
−
7
TO BULKHEAD
AT 12564

Figure 2-41. Horn circuit wiring diagram.

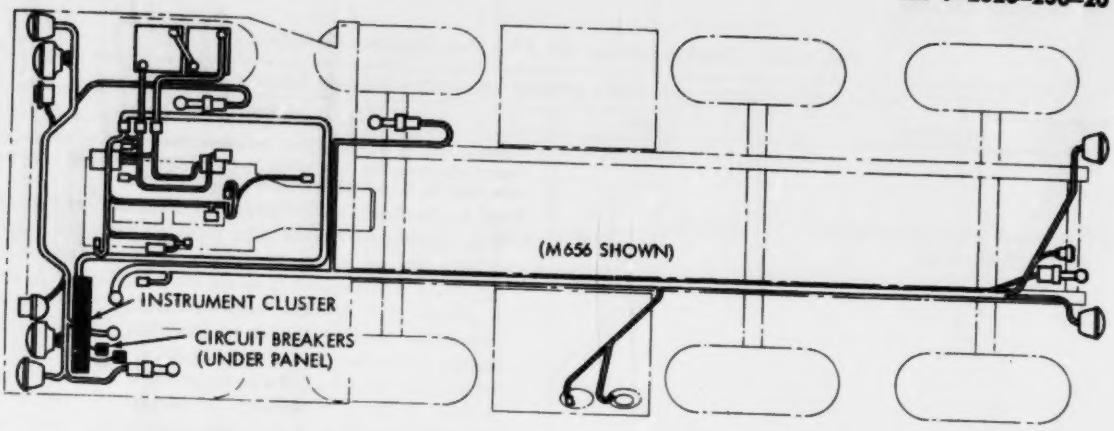
Table 2-5. Troubleshooting the Electrical System—Continued

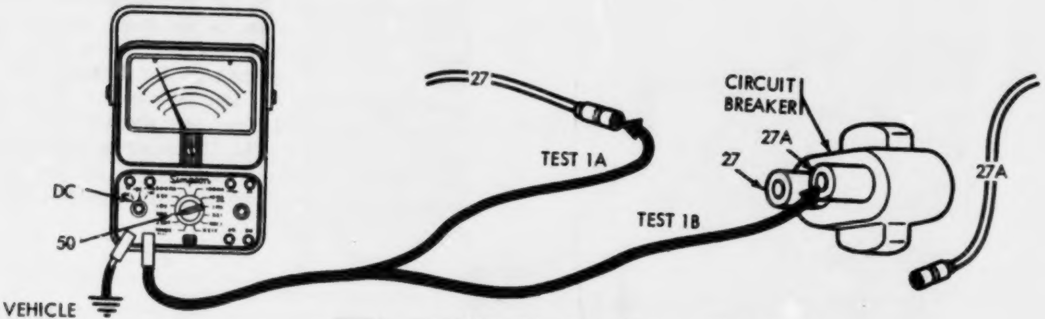
INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-42)

Malfunction	Circuit	Test
		Note. When the instrument cluster panel is removed from the vehicle dash panel, wire 57 must remain connected to the instrument cluster panel common ground terminal, or a jumper wire must be connected from the common ground terminal to wire 57 or the vehicle frame to provide a return circuit for the indicator lights and gage actuators.
All gages inoperative.	27, 27A	Test 1. Perform instrument cluster quick voltage test. Set up the multimeter for voltage tests (see fig. 2-9). Disconnect No. 27 wire at the circuit breaker. Connect the red test lead to the connector on wire No. 27, and the black test lead to the vehicle frame, as shown in figure 2-42, test 1A. Turn the master switch to "ON" position. If 24 volts is not indicated, master switch or its wiring is defective. Refer to figure 2-19, test 3. If 24 volts is indicated, restore the No. 27 wire to the circuit breaker and remove No. 27A wire from the other circuit breaker terminal. Connect the red test lead to the pin in the circuit breaker, as shown in figure 2-42, test 1B. If 24 volts is indicated, restore the No. 27A wire to the circuit breaker and perform test 2. If 24 volts is not indicated at the circuit breaker pin, the circuit breaker is defective. Install a new circuit breaker and repeat the test.
	27, 27A, 57	Test 2. Perform indicator system voltage test. Remove the instrument cluster panel. Disconnect No. 27A wire at one of the gages. Set up multimeter for voltage tests (see fig. 2-9) and connect voltmeter as shown in figure 2-42, test 2. Turn master switch to "ON" position. If 24 volts is not indicated, check circuit No. 27A from the instrument cluster to the circuit breaker for breaks or loose connections. Repair as required. If 24 volts is indicated, set up the multimeter for continuity tests (see figure 2-12). Check continuity between the instrument cluster common ground and the vehicle frame. If there is no continuity, check circuit. No. 57 for breaks or loose connections. If circuit No. 57 is continuous, check gage mountings and ground terminal for corrosion or loose mounting.

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-43)

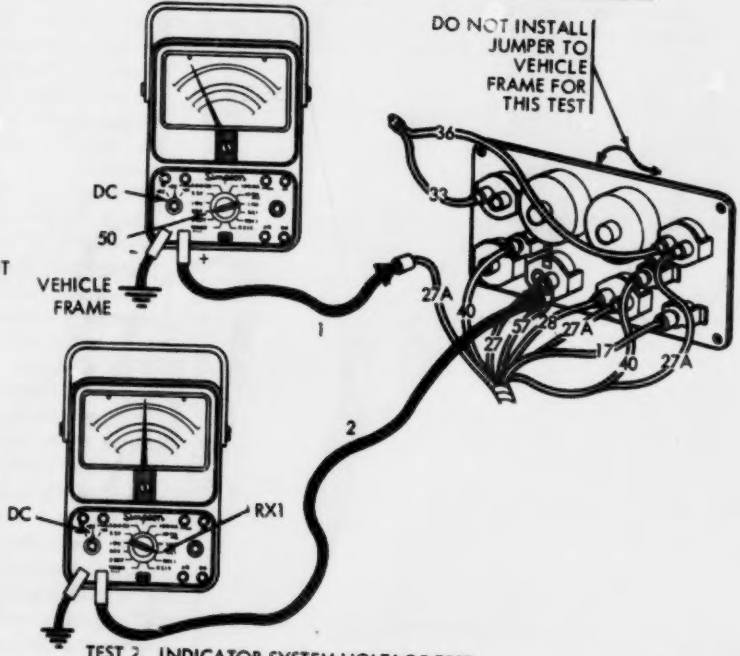
Malfunction	Circuit	Test
One gage inoperative.	27A, 28, 33, 36	Test 3. Perform individual gage voltage test. Remove wire and connector from inoperative gage. Set up multimeter for voltage tests (see fig. 2-9) and connect voltmeter negative lead to vehicle frame. Connect voltmeter positive lead to terminal of gage, as shown in figure 2-43, test 3. Turn master switch to "ON" position and observe reading. If reading is 3 to 4 volts for fuel level gage and oil pressure gage circuit or 24 volts for temperature gage, perform transmitter resistance test. If no reading is indicated, check gage wire and connector for breaks or loose connections. If satisfactory, gage is faulty.


(M656 SHOWN)
INSTRUMENT CLUSTER
CIRCUIT BREAKERS
(UNDER PANEL)


27
TEST 1A
CIRCUIT
BREAKER
27A
27
27A
TEST 1B
DC
50
VEHICLE
FRAME

TEST 1. INSTRUMENT CLUSTER VOLTAGE FEED TEST

WIRE NO.	CIRCUIT
17	HIGH BEAM INDICATOR
27A	24 VOLTS FEED
27	24 VOLTS FEED
28	TO FUEL GAGE SENDING UNIT
33	TO TEMP. GAGE SENDING UNIT
36	TO OIL PRESS. GAGE SENDING UNIT
40	INSTRUMENT PANEL LIGHT
57	INSTRUMENT CLUSTER GROUND WIRE


DO NOT INSTALL
JUMPER TO
VEHICLE
FRAME FOR
THIS TEST
36
33
DC
50
-
+
VEHICLE
FRAME
1
27A
40
27
57
28
27A
17
40
27A
2
DC
RX1

TEST 2. INDICATOR SYSTEM VOLTAGE TEST

AT 12565

Figure 2-42. Instruments, gages and horn system tests, 1 and 2.

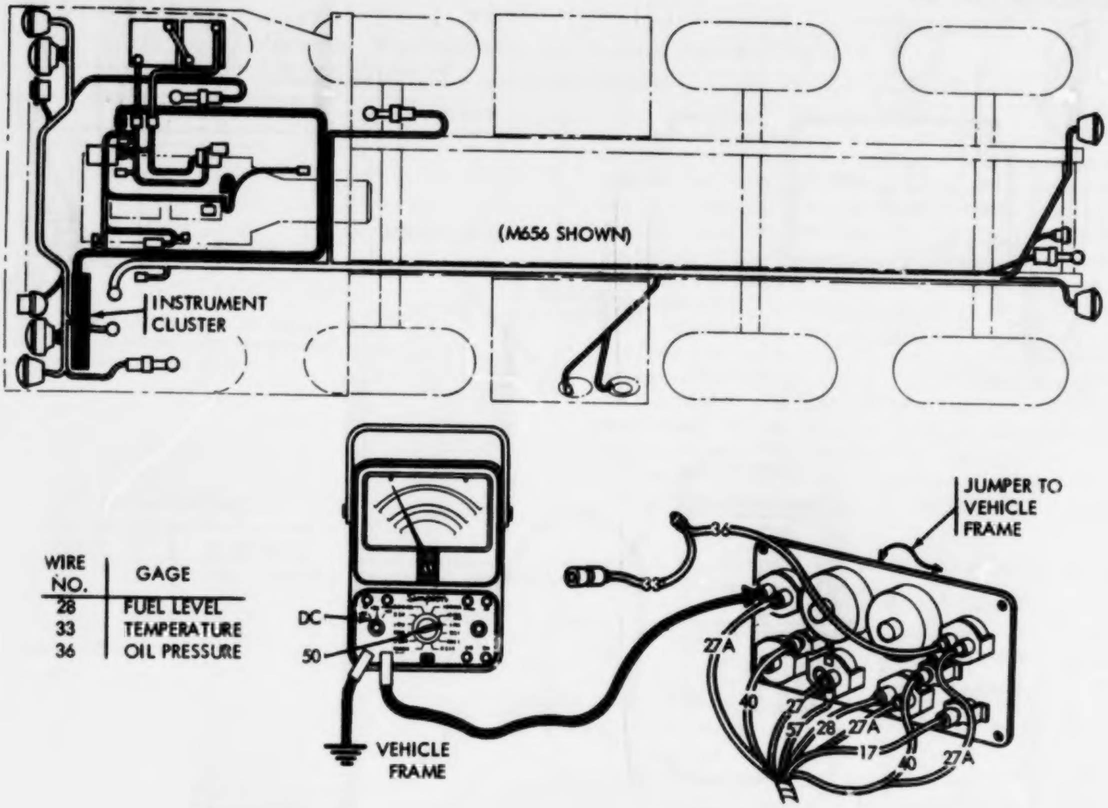
Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-43)

Malfunction	Circuit	Test
		Note. Test 3 is useful for troubleshooting only a completely inoperative gage. For a complete test procedure, including accuracy tests, refer to TB 9-2300-228-20 and TB ORD 434.
Oil pressure gage inoperative (transmitter test).	27A, 36	Test 4. Perform oil pressure transmitter resistance test. Disconnect No. 36 wire from oil pressure transmitter. Set up multimeter for resistance tests (see fig. 2-11) and connect it as shown in figure 2-43, test 4. Start and operate engine at high idle speed. Ohmmeter reading should be less than 1 ohm before engine is started, and rise to about 6 to 10 ohms for normal oil pressures. Refer to conversion table shown in test 4 for a conversion of resistance values to pressures. If sending unit has more than 1 ohm resistance with engine "OFF" or considerably different resistances than shown in the table, transmitter is faulty. If resistance agrees with table, shut off engine and set up multimeter for voltage test (fig. 2-9). Connect red test lead to wire No. 36 as shown in figure 2-43, test 4. Turn on master switch. Voltage should read 3 to 4 volts. If less or no voltage, check main wiring harness (wire No. 36) for open circuit or loose connection. If more, perform test 3, above, to check for faulty gage.

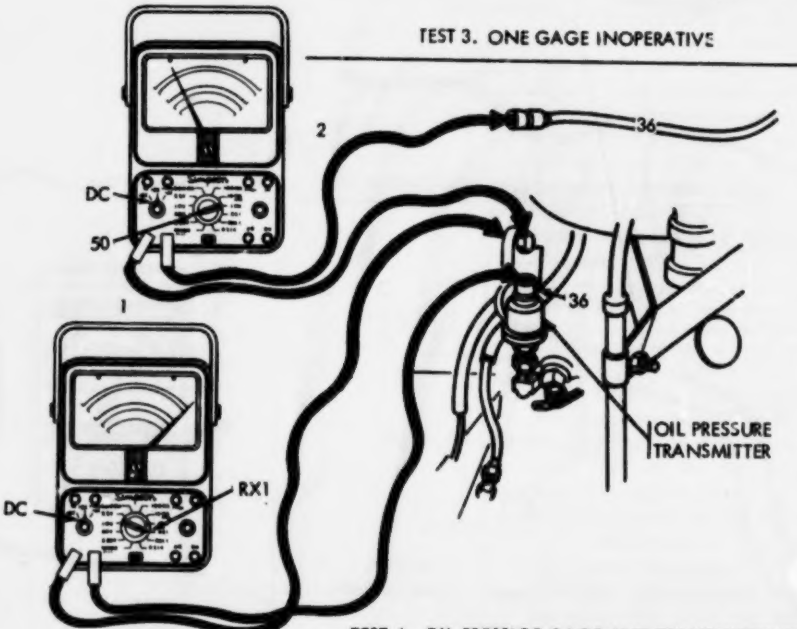
INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-44)

Malfunction	Circuit	Test
Temperature gage inoperative (transmitter test).	27A, 33	Test 5. Perform temperature transmitter resistance test. Remove radiator filler cap and insert a test thermometer into coolant. Set up the multimeter for resistance tests (see fig. 2-11) and connect it as shown in figure 2-44, test 5A. Start and operate the engine from a cold start. Observe the thermometer as the engine warms up and make resistance measurements at 120, 160 and 180 degrees F. Refer the ohmmeter readings to the conversion table shown in test 5. Values within 10% of the chart figures are acceptable. If in doubt, substitute a new temperature transmitter and repeat the test. If the transmitter resistance varies more than 10%, or does not rise smoothly, transmitter is faulty. If resistance agrees with table, set up multimeter for voltage tests (fig. 2-9). Connect the red test lead to wire No. 33 as shown in figure 2-44, test 5B. Turn on master switch. Voltage should read 24 volts. If less than 24 volts check main wiring harness (wire No. 33) for open circuit or loose connections.
Fuel level gage inoperative (transmitter test).	27A, 28	*Caution:* **Be very careful when making electrical tests near the fuel tank. When components have been removed, cover the tank opening with tape or appropriate material. Conduct electrical tests in a remote area as far as possible from the open fuel tank. DO NOT PERMIT smoking, sparks, or open flame within 50 feet of vehicle and fuel tank undergoing test and repair.**


(M656 SHOWN)
INSTRUMENT CLUSTER
JUMPER TO VEHICLE FRAME
36
33
DC
50
VEHICLE FRAME
27A
40
27
57
28
27A
17
40
27A

WIRE NO.	GAGE
28	FUEL LEVEL
33	TEMPERATURE
36	OIL PRESSURE

TEST 3. ONE GAGE INOPERATIVE


2
36
DC
50
36
1
DC
RX1
OIL PRESSURE TRANSMITTER

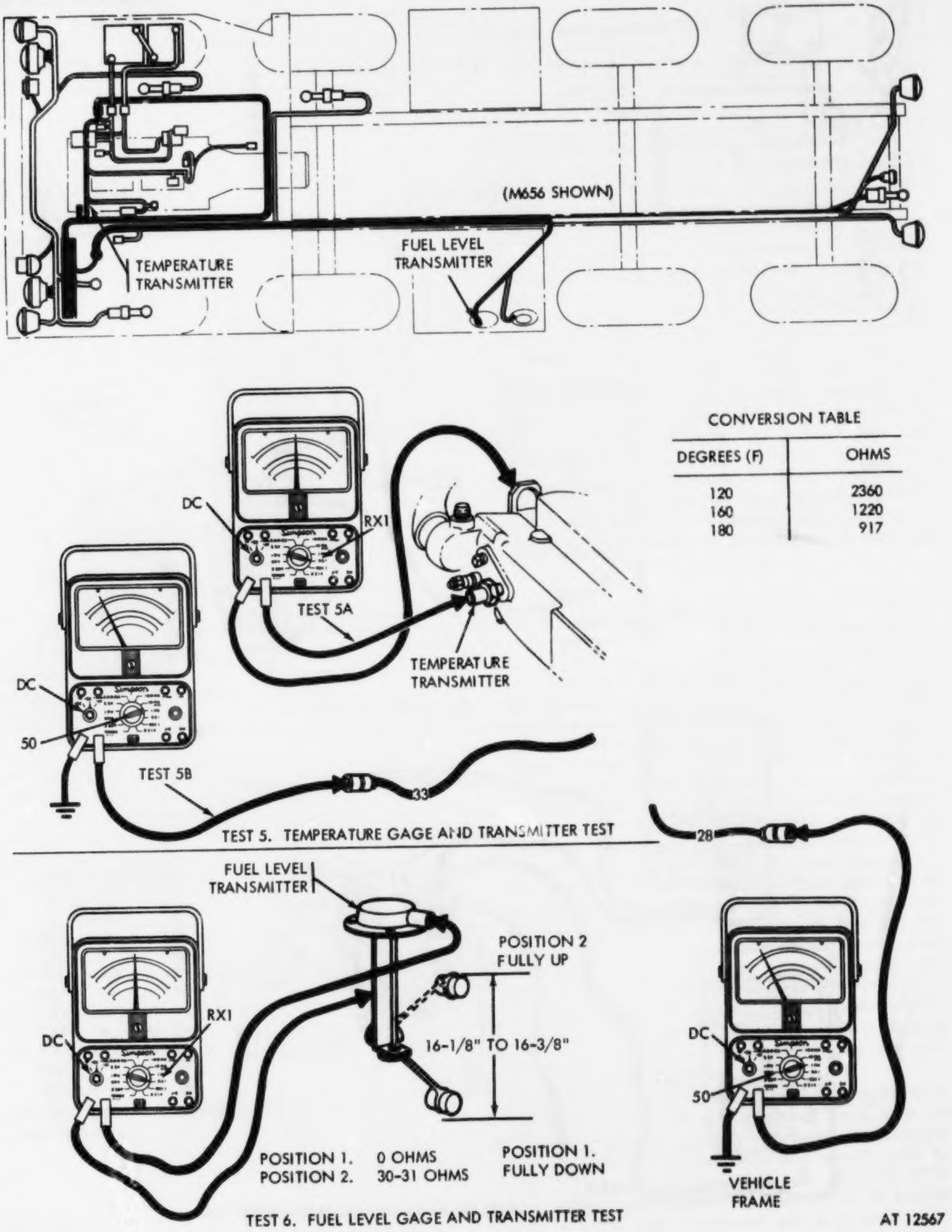
CONVERSION TABLE

PSI	OHMS		
0	0	to	1.0
10	3.5	to	5.5
15	6.0	to	8.5
20	8.5	to	11.0
25	11.0	to	13.5
30	14.5	to	16.5
35	16.5	to	17.5
40	19.0	to	20.0
60	28.0	to	31.0

TEST 4. OIL PRESSURE GAGE AND TRANSMITTER TEST

AT 12566

Figure 2-43. Instruments, gages and horn system tests, 3 and 4.


(M656 SHOWN)
TEMPERATURE TRANSMITTER
FUEL LEVEL TRANSMITTER
DC
RX1
TEST 5A
TEMPERATURE TRANSMITTER
DC
50
TEST 5B
33
28
TEST 5. TEMPERATURE GAGE AND TRANSMITTER TEST
FUEL LEVEL TRANSMITTER
POSITION 2 FULLY UP
RX1
DC
16-1/8" TO 16-3/8"
POSITION 1. 0 OHMS
POSITION 2. 30-31 OHMS
POSITION 1. FULLY DOWN
DC
50
VEHICLE FRAME
TEST 6. FUEL LEVEL GAGE AND TRANSMITTER TEST
AT 12567

CONVERSION TABLE

DEGREES (F)	OHMS
120	2360
160	1220
180	917

Figure 2-44. Instruments, gages and horn system tests, 5 and 6.

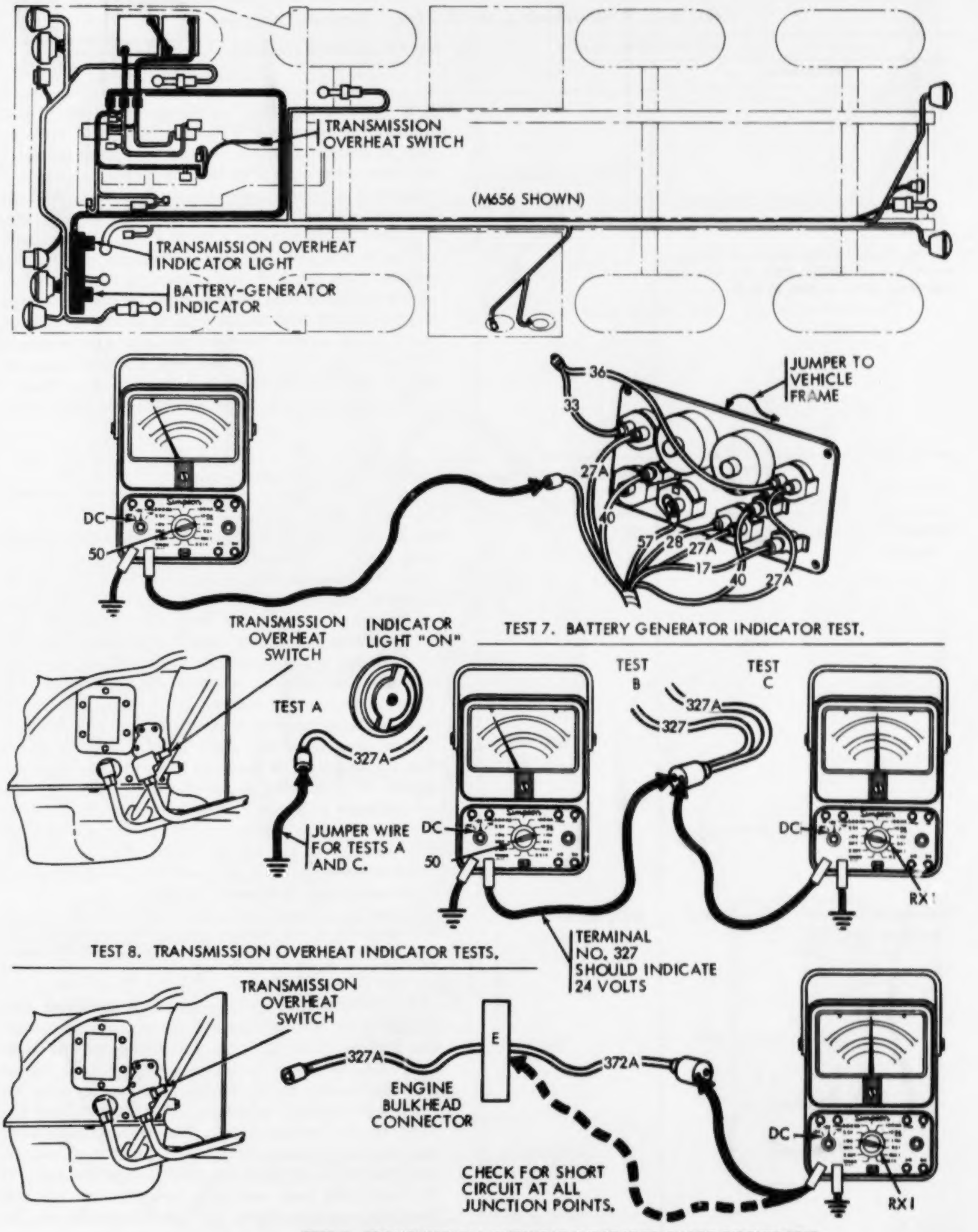
Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued

Malfunction	Circuit	Test
Note. Tests for the fuel level indicator circuit for the XM757 truck are described separately. Refer to tests 12 to 14.		Test 6. Perform fuel level transmitter test. Set up multimeter for resistance tests (see fig. 2-11) and connect as shown in figure 2-44, test 6. Move transmitter float from bottom to top. An uneven increase in resistance or erratic meter needle movement indicates the fuel level transmitter is faulty. If the resistance increases smoothly from 0 to 30 ohms, the transmitter is serviceable. Set up multimeter for voltage readings (see fig. 2-9) and connect to wire No. 28 as shown in figure 2-44, test 6. Turn on master switch. Voltage should read 3 to 4 volts. If less or no voltage, check main wiring harness through rear toeboard connector pin "J" to the fuel level gage for open circuit or loose connections. If voltage is more than 4 volts, perform test 3, above, to check for faulty gage.

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-45)

Malfunction	Circuit	Test
Battery-generator indicator inoperative.	27	Test 7. Perform battery-generator indicator voltage test. Set up multimeter for voltage tests (see fig. 2-9). Test battery for normal voltage. Remove instrument cluster panel and keep wire No. 57 intact, or connect a jumper wire from the instrument cluster ground to the vehicle ground. Disconnect wire No. 27 from the battery-generator indicator and connect it to the voltmeter as shown in figure 2-45, test 7. Turn on the master switch. If 24 volts is indicated, make a visual inspection of the battery-generator indicator case, terminals and mounting bracket ot see that the indicator is properly grounded through circuit 57. If grounding is satisfactory, battery-generator indicator is faulty. However, if wire No. 27 shows less than battery voltage, check harness wiring from the indicator to the master switch for loose or corroded connections or broken wires. Also check circuit 57 for continuity to chassis ground.
Transmission overheat indicator fails to light.	327, 327A	*Note.* Inasmuch as this system operates only when a malfunction occurs, there will be no evidence of failure if the transmission temperature remains below 305°F. The following test simulates a malfunction and should be made periodically when other similar engine maintenance is performed. Test 8. Perform transmission overheat indicator test. Remove wire No. 327A from the transmission overheat switch, located in an oil fitting on the right hand side of the transmission. Connect a jumper from the vehicle frame to the connector on wire No. 327A just removed, as shown in figure 2-45, test 8A. Turn on the master switch. The transmission overheat indicator lamp should light. If it does not, remove the indicator light cap and replace the lamp. If the lamp still does not light, remove wire No. 327 from the overheat light. Set up the multimeter for voltage tests (see fig. 2-9). With the master switch


TRANSMISSION OVERHEAT SWITCH
(M656 SHOWN)
TRANSMISSION OVERHEAT INDICATOR LIGHT
BATTERY-GENERATOR INDICATOR
JUMPER TO VEHICLE FRAME
36
33
27A
40
57
28
27A
17
40
27A
DC
50
Simpson
TRANSMISSION OVERHEAT SWITCH
INDICATOR LIGHT "ON"
TEST A
327A
JUMPER WIRE FOR TESTS A AND C.
TEST B
TEST C
327A
327
DC
50
DC
RX1
TERMINAL NO. 327 SHOULD INDICATE 24 VOLTS
TRANSMISSION OVERHEAT SWITCH
327A
E
372A
ENGINE BULKHEAD CONNECTOR
CHECK FOR SHORT CIRCUIT AT ALL JUNCTION POINTS.
DC
RX1

TEST 7. BATTERY GENERATOR INDICATOR TEST.

TEST 8. TRANSMISSION OVERHEAT INDICATOR TESTS.

TEST 9. TRANSMISSION OVERHEAT INDICATOR SHORT CIRCUIT TEST.

AT 12568

Figure 2-45. Instruments, gages and horn system tests, 7, 8 and 9.

Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-45)

Malfunction	Circuit	Test
		still in "ON" position, touch the red test lead to the connector on wire No. 327 just removed, as shown in figure 2-45, test 8B. If 24 volts is indicated, circuit 327A from the lamp to the transmission has an open circuit. Turn off master switch and make a continuity test of the entire circuit 327A as shown in test 8C (see fig. 2-39) for routing). When the lamp lights satisfactorily with the jumper wire (test 8A), the overheat circuit is operating properly, except for the overheat switch. If there is reason to doubt the proper operation of this switch, replace it with a new one. Actual testing of the switch is impractical, since it closes at 305° F., and reopens at 275° F. and any hot water test would not go beyond 212 °F.
Transmission overheat switch indicator lights at all times master switch is on.	327, 327A	Test 9. Perform transmission overheat indicator short circuit test. *Note.* If the truck has recently been running, the possibility exists that this condition is caused by an actual overheated transmission. Allow the transmission to cool sufficiently, and make another check. If the indicator still lights with a cool transmission, continue with the test. Remove wire No. 327A at the transmission. If the overheat lamp now goes out, the transmission overheat switch is defective. Replace switch. If the lamp still lights, remove wire No. 327A from the lampholder at the instrument panel. If the lamp still lights, the lampholder is shorted to the instrument panel. Check for corrosion, or if grounded, replace lampholder. If the lamp goes out when wire No. 327A is removed from the lampholder, set up the multimeter for continuity tests (see fig. 2-12). Check complete circuit 327A from the lampholder to the transmission for short circuits, as shown in figure 2-45, test 9. Repair where necessary. When repairs are completed, test the circuit as shown in test 8, above.

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-46)

Malfunction	Circuit	Test
Instrument cluster panel lamps inoperative, one or both.	40	Test 10. Perform instrument cluster panel lamp test. Remove lampholder caps and replace defective lamp. Set lighting switch in position to turn on the instrument cluster panel lamps. If lamps still do not light, remove wire No. 40 from either or both lampholders. Set up multimeter for voltage tests (see fig. 2-9). Connect red test lead to wire No. 40 connector just removed, and the black test lead to vehicle frame as shown in figure 2-46, test 10. If 24 volts is indicated with light switch in the "ON" position, the lampholders are defective. Check for corrosion or dirt in sockets or on terminals. Repair or replace as required. If 24 volts is not indicated on connector of wire No. 40, check the wiring harness from the lamps to the light switch for broken wires or loose connections. If satis-

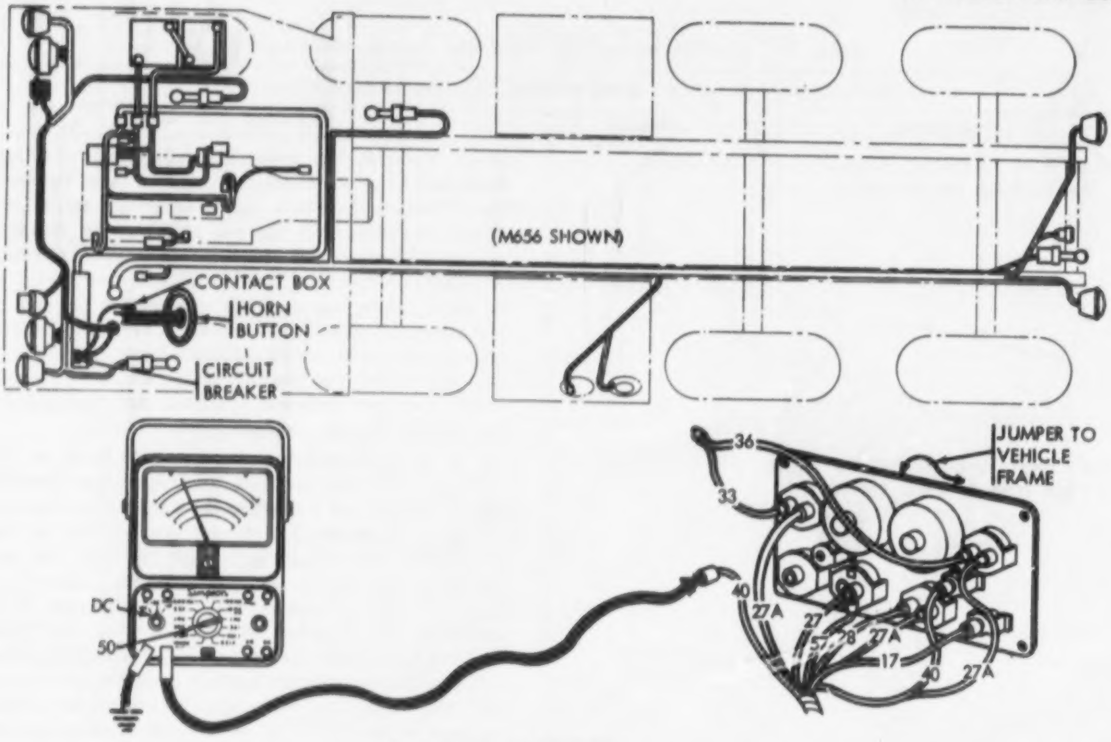
Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-46)

Malfunction	Circuit	Test
		factory, perform light switch test as shown in figure 2-33, test 9.
Horn inoperative.	25	Test 11. Perform horn circuit voltage test. Disconnect the two No. 25 wires from the horn. Set up the multimeter for voltage tests (see fig. 2-9) and connect as shown in figure 2-46, test 11. Test both No. 25 wires for voltage. One wire should read zero volts, and the other should read 24 volts. If 24 volts is indicated on one No. 25 wire at the horn, connect this wire to the horn and connect a jumper wire from the other horn terminal to the vehicle frame. If horn does not operate, it is faulty. If horn operates, remove the jumper and reconnect both wires to the horn. Disconnect wire No. 25 and No. 57 from the cover and contact assembly at the base of the steering column. Touch these wires together; if horn operates, check horn switch assembly in steering wheel hub. Repair as required. If, at the beginning of the test, neither one of the No. 25 wires showed 24 volts, test the No. 25 terminal at the circuit breaker mounted under the instrument panel to the left of the steering column. If 24 volts appears here, inspect the No. 25 wire to the horn for breaks or loose connections. If no voltage appears at the circuit breaker terminal, test the other terminal of the circuit breaker. If 24 volts is indicated, the circuit breaker is faulty. If no voltage appears at this point, check wire No. 10 in the wiring harness for broken wires or loose connections. Repair as required.

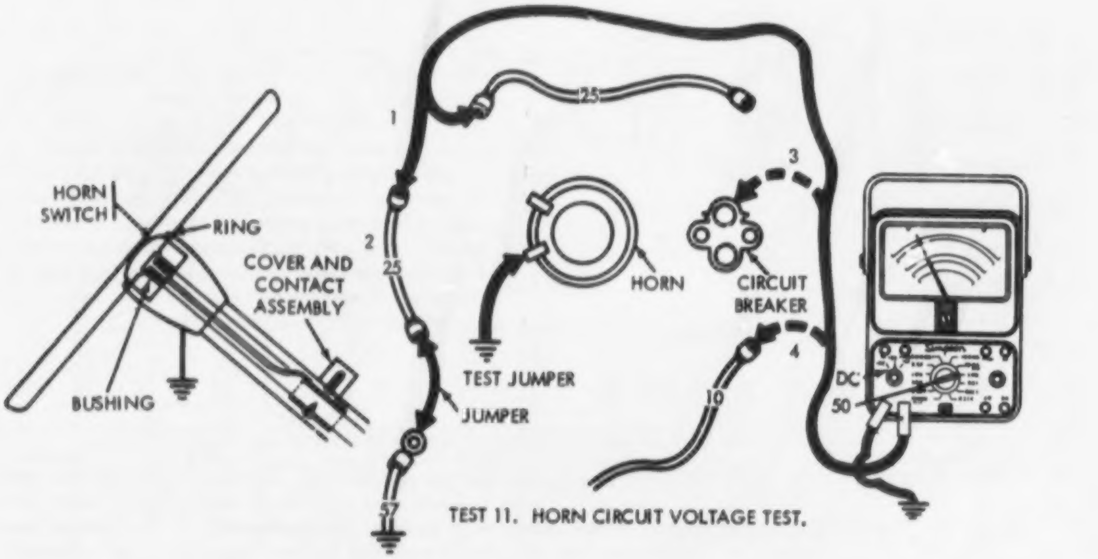
INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-47)

Malfunction	Circuit	Test
		ADDITIONAL TEST FOR DUAL FUEL INDICATOR SYSTEM INSTALLED ON XM757 TRUCKS
Fuel level indicator does not indicate on either tank.	28R, 28L, 28	Test 12. Perform fuel indicator system test. Set up the multimeter for voltage tests (see fig. 2-9). Remove connectors from fuel transmitters at tank. Connect the black test lead to the vehicle frame and the red test lead to the connector just removed. Turn on the master switch and position the fuel pump transfer switch to the tank being measured. If 3 to 4 volts is indicated, check the fuel level transmitter (test 6). If no voltage is indicated remove the connector from the fuel pump transfer relay, located on the bulkhead under the circuit breakers. Connect the black test lead to the relay case ground terminal, and touch the red test lead to wire No. 28 in contact "C" in the harness cable connector just removed, as shown in figure 2-47, test 12. When 3 to 4 volts is indicated on contact "C" and one or both indicators do not function, perform test 13.



(M656 SHOWN)
CONTACT BOX
HORN BUTTON
CIRCUIT BREAKER
JUMPER TO VEHICLE FRAME
36
33
40
27A
27
57
8
27A
17
40
27A
DC
50

TEST 10. PANEL LAMP TEST



HORN SWITCH
RING
COVER AND CONTACT ASSEMBLY
BUSHING
1
25
2
25
TEST JUMPER
JUMPER
57
HORN
3
CIRCUIT BREAKER
4
10
DC
50

TEST 11. HORN CIRCUIT VOLTAGE TEST.

AT 12569

Figure 2-46. Instruments, gages and horn system tests 10 and 11.

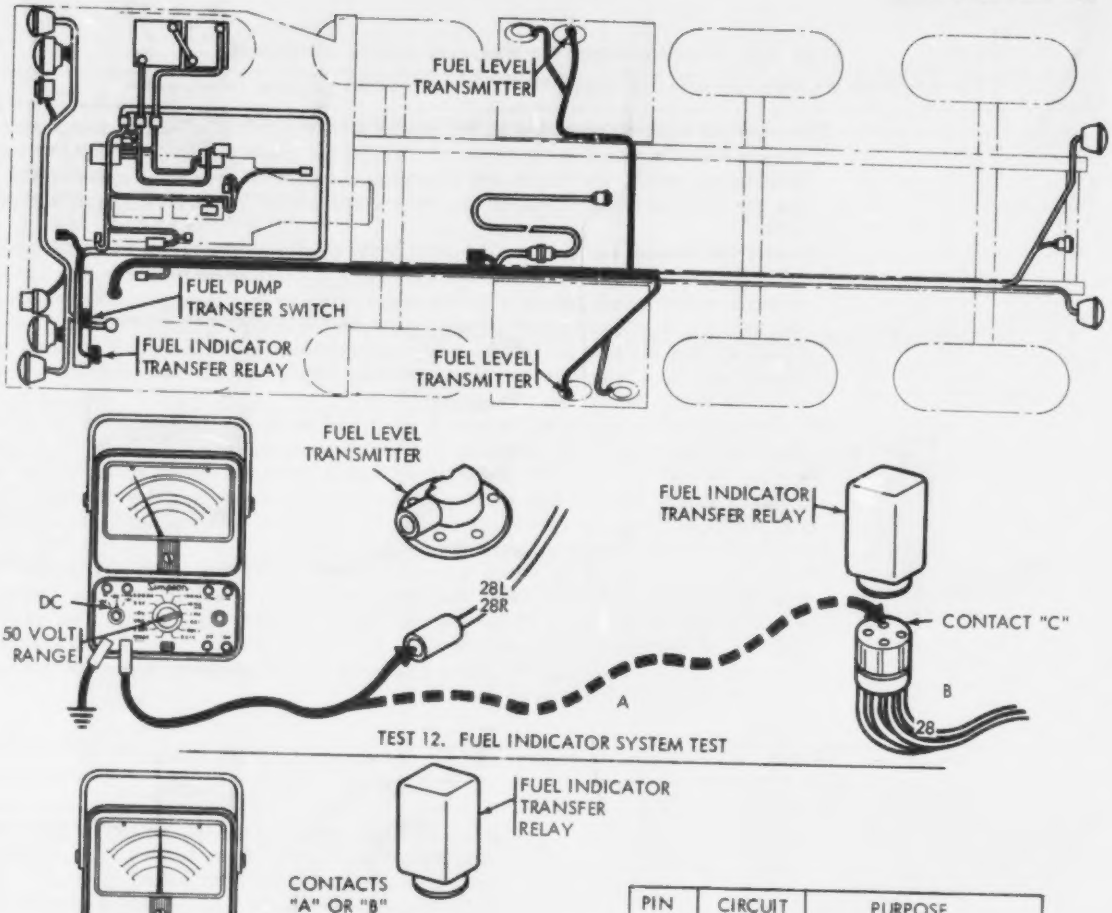
Table 2-5. Troubleshooting the Electrical System—Continued

INSTRUMENTS, GAGES AND HORN SYSTEM CIRCUITS—Continued (Figure 2-47)

Malfunction	Circuit	Test
Fuel level indicator indicates on one tank but not the other.	28R, 28L	Test 13. Perform fuel system harness continuity test. Re-install the connectors on the fuel tank transmiters. Connect the black test lead to the relay case ground terminal and the red test lead on contacts "A" or "B" of the harness cable connector as shown in figure 2-47, test 13. The resistance should be 1 to 40 ohms, depending upon the quantity of the fuel in the tanks. If infinite resistance, or very high resistance is indicated, check wiring harness circuit No. 28R and/or 28L for loose or broken wires. When continuity has been restored, re-install the relay connector and test the system again.
Left hand tank normal but right hand tank does not indicate.	28, 28R, 28L, 78	Test 14. Perform relay continuity test. Turn on the master switch and position the fuel pump transfer switch to the right hand tank. Remove the harness connector from the fuel transfer relay. Set up the multimeter for voltage tests (see fig. 2-9) and clip the black test lead to the vehicle frame. Connect the red test lead to contact "D" of the harness cable connector just removed. If 24 volts is not indicated, and the right hand fuel pump is operating normally, check wire No. 78 in the harness from the fuel transfer relay to the fuel pump transfer switch for broken or loose connection. If 24 volts is indicated on contact "D" of the harness connector, set up the multimeter for continuity tests (see fig. 2-12). Connect the black test lead to the relay case ground terminal and the red test lead to contact "D" of the relay. The resistance should be very low (about 10 ohms). If infinity, or very high resistance, is measured, the relay coil is defective. Replace the relay. If the coil resistance is about 10 ohms, connect the black test lead to contact "C" of the relay and the red test lead to contact "B." Continuity (zero resistance) should be indicated between contacts "C" and "B". If no continuity is indicated, the relay has defective contacts. Replace relay. If continuity is good between "C" and "B" move the red test lead to contact "A". Very carefully connect a jumper between a source of 24 volts and contact "D" of the relay. When the relay operates, continuity should be measured between contacts "A" and "C" of the relay. If no continuity is indicated, relay contacts are defective. Replace relay.

MANIFOLD HEATER AND LOW PRESSURE WARNING SYSTEM (Figure 2-48)

DESCRIPTION: The manifold heater is an assembly that preheats the intake manifold for cold weather starting. The electrical circuit consists of a manifold heater switch, circuit breaker and an internal igniter and blower system. Troubleshooting of this system consists only of determining that 24 volts is provided at the manifold heater connector for proper operation of the manifold heater, and replacement of the igniter when required.


FUEL LEVEL TRANSMITTER
FUEL PUMP TRANSFER SWITCH
FUEL INDICATOR TRANSFER RELAY
FUEL LEVEL TRANSMITTER
FUEL LEVEL TRANSMITTER
FUEL INDICATOR TRANSFER RELAY
DC
50 VOLT RANGE
28L
28R
CONTACT "C"
A
B
28
FUEL INDICATOR TRANSFER RELAY
CONTACTS "A" OR "B"
RX1
DC
28L
28R
FUEL INDICATOR TRANSFER RELAY
CONTACT "D"
DC
50
+
VEHICLE FRAME
A
78
TO CONTACT "D"
TRANSFER RELAY
TO CONTACTS "A" AND "C"
RX1
DC
+
B
TO CONTACTS "B" AND "C"
C
CONTACT "D"
JUMPER TO 24 VOLTS
D
AT 12570

TEST 12. FUEL INDICATOR SYSTEM TEST

PIN	CIRCUIT	PURPOSE
A	28R	RIGHT TANK
B	28L	LEFT TANK
C	28	FUEL LEVEL INDICATOR
D	78	RELAY COIL

TEST 13. FUEL SYSTEM HARNESS TEST

TEST 14. RELAY CONTINUITY TEST

Figure 2-47. Dual fuel tank system tests, XM757 truck.

Table 2-5. Troubleshooting the Electrical System—Continued

MANIFOLD HEATER AND LOW AIR PRESSURE WARNING SYSTEM—Continued (Figure 2-48)

The manifold heater is energized by the manifold heater switch, after the master switch is turned on. Current flows from circuit 27 from the master switch, through the manifold heater switch, via circuit 486 through a circuit breaker, then via circuit 486 to the manifold heater, mounted on the right hand side of the engine. Refer to figure 2-48.

The manifold heater may be tested by turning the master switch on, pressing the manifold heater switch, and observing that the heater is functioning properly. The low air pressure warning indicator is a buzzer which operates whenever the air pressure is below 60 psi. It will continue to operate until the vehicle air pressure has built up to 90 psi. During starting operations, and whenever necessary for tactical reasons, the buzzer may be silenced by a spring-operated cut-off switch. However, the cut-off switch cannot be locked into off position.

The low air pressure indicator (buzzer) is energized by an air-operated pressure switch after the master switch is turned on. Current flows from circuit 27 from the master switch, through the normally-closed cut-off switch, then via circuit 85 to the low air pressure switch, and through a short connector cable tc the indicator (buzzer). The return circuit is via the vehicle cab grounding conductor (marked GRD) to circuit 7 to the negative battery terminal. Refer to figure 2-48.

The low air pressure warning system may be tested by turning the master switch on, and if the vehicle has been parked long enough to have reduced air pressure below 60 psi, listening for the sound of the warning buzzer. Depress the buzzer cut-off switch, and note if the buzzer is silenced. Release the cut-off switch to check if the buzzer restarts. If possible, start the engine and build up air pressure beyond 90 psi and note if buzzer continues operation.

MANIFOLD HEATER AND LOW AIR PRESSURE WARNING SYSTEM—Continued (Figure 2-49)

Malfunction	Circuit	Test
Engine manifold heater inoperative.	486	Test 1. Perform manifold heater voltage supply test. Remove wire No. 486 from terminal on manifold heater. Set up multimeter for voltage tests (see fig. 2-9). Connect red test lead to connector on wire No. 486 just removed and the black test lead to vehicle ground. Turn master switch to "ON" and depress the manifold heater button. If 24 volts is indicated on the meter, replace the ignitor plug and retest the manifold heater. If the heater still does not operate, notify direct support maintenance personnel. If low or no voltage is indicated in test 1, reconnect wire No. 486 to its terminal on manifold heater. Test 2. Perform circuit breaker voltage test. Disconnect wire No. 486 from each terminal of 15-AMP circuit breaker located in cab. Attach black voltmeter lead to vehicle ground. Turn master switch "ON" and depress manifold heater button. With red test lead check for 24 volts on each wire No. 486, as shown in figure 2-49, test 2. If 24 to 28 volts is indicated in one of the two No. 486 wires, connect this wire to one terminal of circuit breaker. Connect red test lead to other terminal on circuit breaker. With master switch turned on, depress manifold heater button. If 24 volts is indicated, circuit breaker is satisfactory. Check wire No. 486 from circuit breaker to connector of engine bulkhead for corrosion or faulty connections, and check harness wiring from connector to

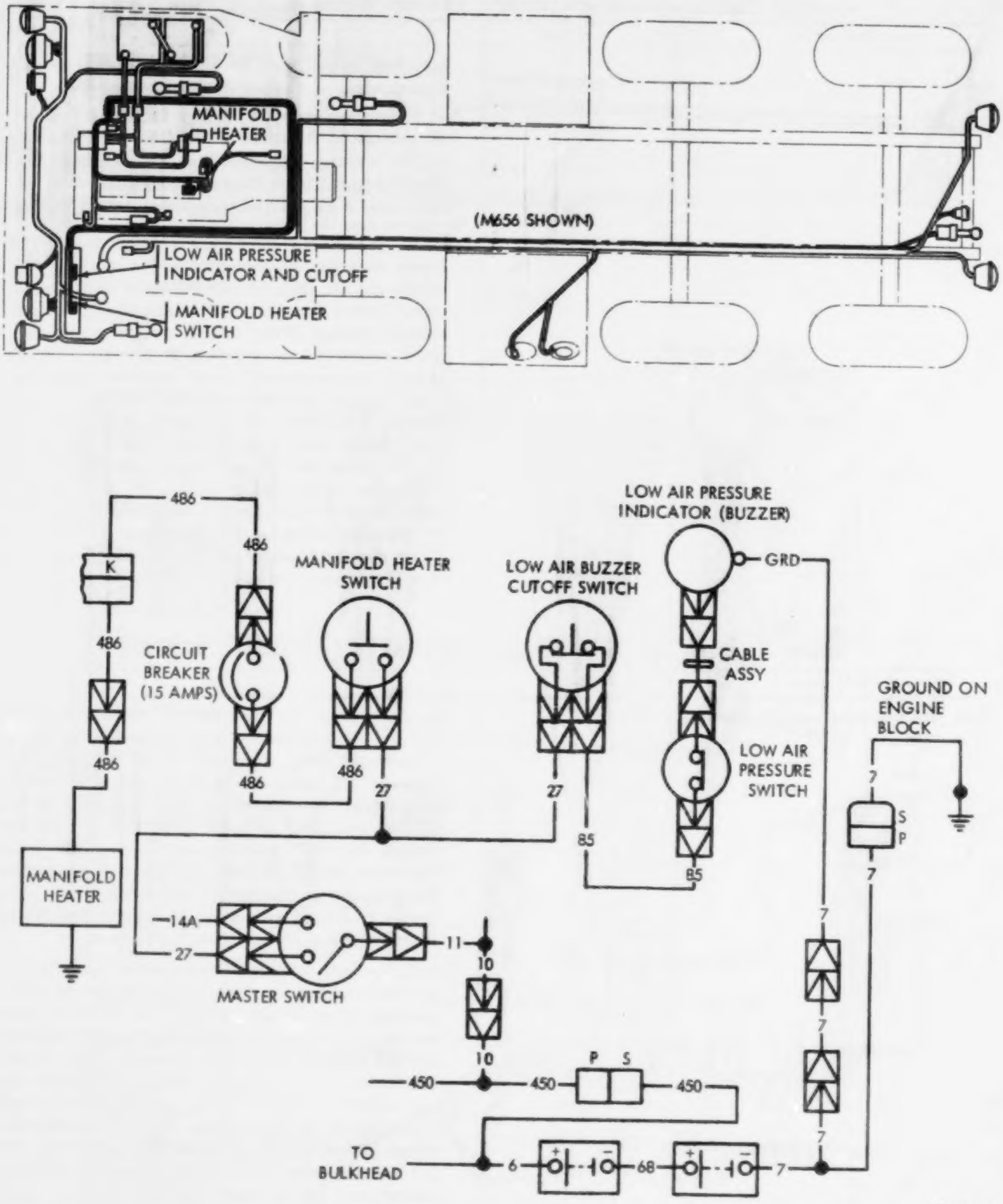

MANIFOLD HEATER
(M656 SHOWN)
LOW AIR PRESSURE INDICATOR AND CUTOFF
MANIFOLD HEATER SWITCH
486
K
486
486
486
CIRCUIT BREAKER (15 AMPS)
486
MANIFOLD HEATER SWITCH
486
27
LOW AIR BUZZER CUTOFF SWITCH
27
85
LOW AIR PRESSURE INDICATOR (BUZZER)
GRD
CABLE ASSY
LOW AIR PRESSURE SWITCH
85
GROUND ON ENGINE BLOCK
7
S
P
7
MANIFOLD HEATER
14A
27
MASTER SWITCH
11
10
10
7
7
7
450
450
P S
450
TO BULKHEAD
6
68
7
AT 12571

Figure 2-48. Manifold heater and low pressure warning indicator wiring diagram.

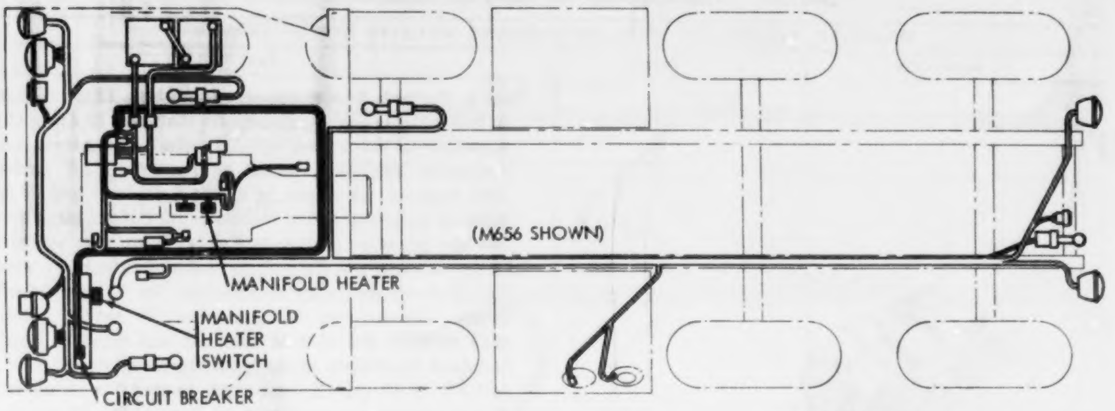
Table 2-5. Troubleshooting the Electrical System—Continued

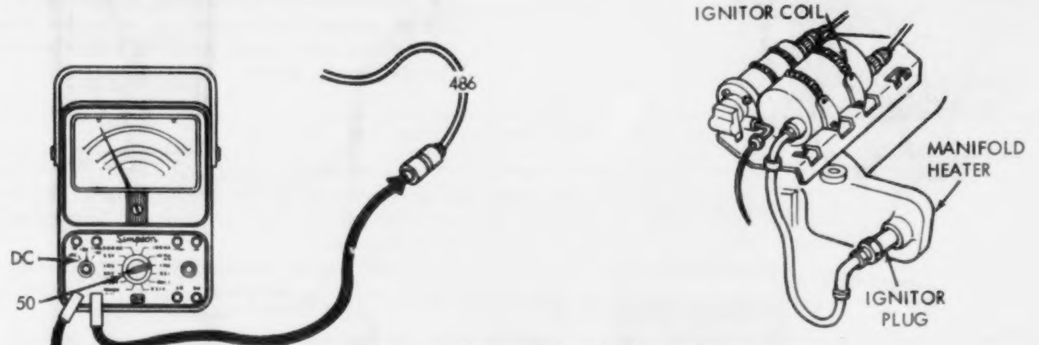
MANIFOLD HEATER AND LOW AIR PRESSURE WARNING SYSTEM—Continued (Figure 2-49)

Malfunction	Circuit	Test
		manifold heater unit on engine for open circuit or broken wire. Test 3. Perform manifold heater switch test. If low or no voltage is indicated when testing for voltage at circuit breaker, reconnect both No. 486 wires to their circuit breaker terminals. *Note.* Access to the manifold heater switch requires that the unit be removed from the panel. Disconnect wire No. 486 at the manifold heater switch. Leave wire No. 27 connected to one of the terminals of the switch. Connect red voltmeter test lead to the other switch terminal and attach black test lead to vehicle ground. With master switch turned on, depress manifold heater switch. If 24 volts is indicated, switch is operational. Check harness wiring to 15-AMP circuit breaker for broken connection or open circuit. If no voltage is indicated, remove wire No. 27 from heater switch terminal. Attach red voltmeter lead to wire No. 27 and black test lead to vehicle ground to verify faulty switch. If 24 volts is indicated on voltmeter, replace manifold heater switch. If voltmeter indicates no voltage present on wire No. 27 at manifold heater switch, harness wiring (wire No. 27) to manifold heater switch is faulty.

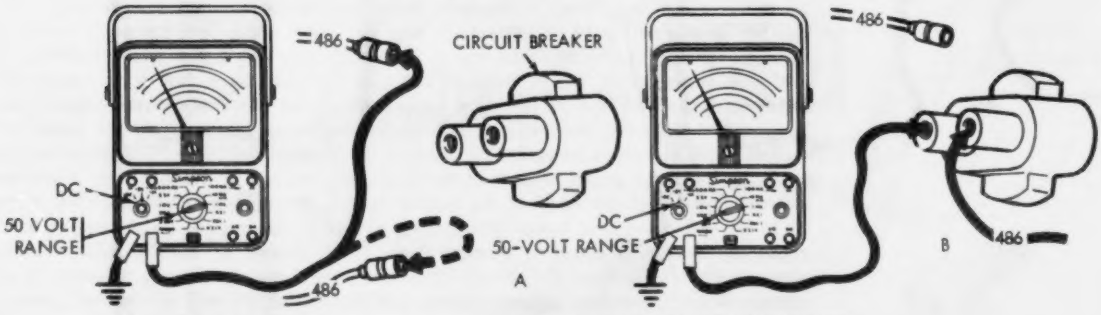
MANIFOLD HEATER AND LOW AIR PRESSURE WARNING SYSTEM—Continued (Figure 2-50)

Malfunction	Circuit	Test
Low air pressure warning buzzer inoperative.	85	Test 1. Perform low air pressure warning buzzer test. Set up multimeter for voltage tests (see fig. 2-9). Disconnect cable connector from warning buzzer. Connect red voltmeter lead to socket of connector just removed and connect black test lead to vehicle ground, as shown in figure 2-50, test 1. Turn master switch to "ON" position and reduce air pressure below 60 psi. If 24 volts is indicated on voltmeter, check warning indicator (buzzer) for proper grounding of frame. If grounding is satisfactory, buzzer is faulty. Replace low air warning buzzer.
	85	Test 2. Perform low air pressure switch test. If no voltage is indicated on warning buzzer end of wire disconnect wire from terminal on low-air pressure switch and attach red voltmeter lead to terminal on low air pressure switch, as shown in figure 2-50, test 2A. If 24 volts is indicated with master switch turned on, jumper is faulty. Repair or replace. If no voltage is indicated, disconnect lead No. 85 from bottom terminal of low air pressure switch. Attach red voltmeter lead to socket (cable end) of wire No. 85 just removed and attach black lead to vehicle ground, as shown in figure 2-50, test 2B. If 24 volts is indicated, low air pressure switch is faulty. Remove and replace low air pressure switch.

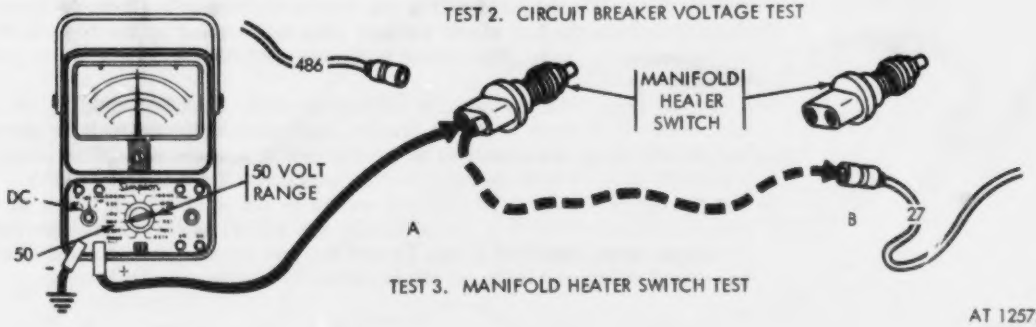

(M656 SHOWN)
MANIFOLD HEATER
MANIFOLD HEATER SWITCH
CIRCUIT BREAKER


IGNITOR COIL
486
MANIFOLD HEATER
DC
50
IGNITOR PLUG
Simpson

TEST 1. MANIFOLD HEATER VOLTAGE SUPPLY TEST


486
CIRCUIT BREAKER
486
DC
50 VOLT RANGE
486
A
DC
50-VOLT RANGE
B
486
Simpson

TEST 2. CIRCUIT BREAKER VOLTAGE TEST


486
MANIFOLD HEATER SWITCH
50 VOLT RANGE
DC
50
-
+
A
B
27
Simpson

TEST 3. MANIFOLD HEATER SWITCH TEST

AT 12572

Figure 2-49. Manifold heater tests.

Table 2-5. Troubleshooting the Electrical System—Continued

MANIFOLD HEATER AND HOW AIR PRESSURE WARNING SYSTEM—Continued

Malfunction	Circuit	Test
	85, 27	Test 3. Perform buzzer cut-off switch test. If no voltage is indicated in test 2, disconnect lead No. 85 from the terminal of the buzzer cut-off switch and attach red voltmeter lead to terminal on buzzer cut-off switch just exposed, as shown in figure 2-50, test 3A. If 24 volts is indicated, wire No. 85 from cut-off switch to low air pressure switch is faulty. Repair or replace. If no voltage is indicated on voltmeter, remove wire No. 27 from the other terminal of the buzzer cut-off switch. Connect red voltmeter lead to socket (cable end) of wire No. 27 just removed, and connect black test lead to vehicle ground, as shown in figure 2-50, test 3B. If 24 volts is indicated, buzzer cut-off switch is faulty. Remove and replace buzzer cut-off switch. If no voltage is indicated on voltmeter, check wire No. 27 for open circuit from the buzzer cut-off switch to the master switch.

FUEL PUMP SYSTEM CIRCUIT (Figure 2-51, 2-52, 2-53)

DESCRIPTION: The fuel pump system electrical components on the M656 and XM791 trucks consist of a 24-volt, electric fuel pump connected directly to the master switch. The fuel pump is energized by turning the master switch to "ON" position. A 2-amp fuse is contained in a housing at the top of the fuel pump.

Current flows from circuit 27 at the master switch, through circuit 77, through the fuel pump, and returns via circuit 79, 91 and 7 to the vehicle battery negative terminal. (Refer to figure 2-51.)

The XM757 truck is equipped with two fuel tanks, with a fuel pump is each tank. A switch on the instrument panel allows the operator to select the tank to be used.

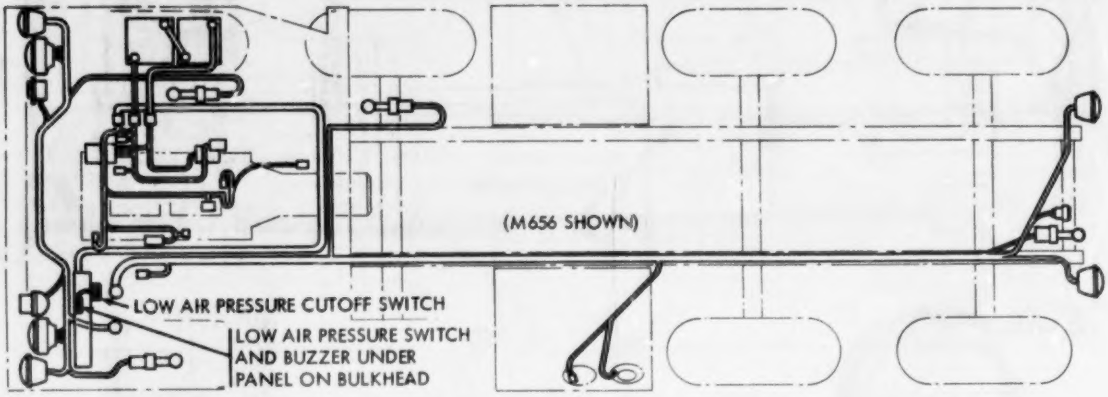
When the left hand tank is in use, operation is similar to the single system. However, when the right hand tank is selected, three operations occur simultaneously. First, the left hand fuel pump is turned off, and the right hand fuel pump is turned on. Second, the fuel indicator relay coil is energized (see fig. 2-47) which switches the fuel level indicator on the instrument panel to the right hand fuel level transmitter, to measure the fuel level in the right hand tank. Third, the fuel return solenoid valve is energized, allowing the excess fuel from the engine to flow to the right hand tank.

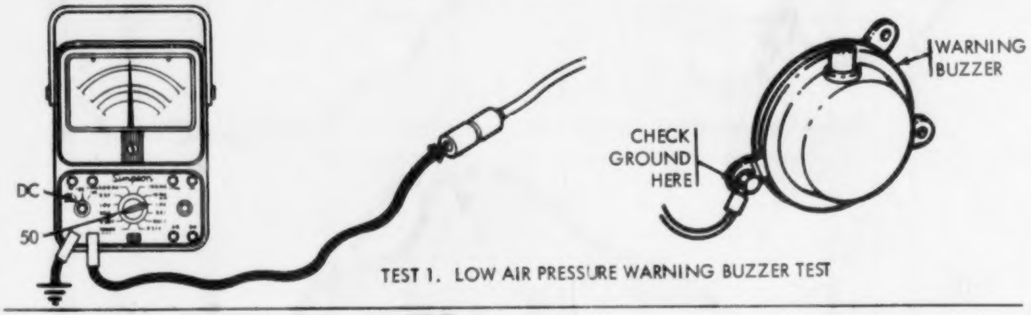
The fuel pump circuit is energized by turning the master switch to "ON" position, and selecting the right or left tank with the fuel pump switch. If the left tank is selected, current flows from circuit 27 at the master switch, through circuit 76, then via circuit 77 to the left hand fuel pump. The return circuit is via circuits 79, 91 and 7. If the right hand tank is selected, current flows from circuit 27 at the master switch, through circuit 76, then via circuit 78 to the right hand fuel pump. Circuit 78 also energizes the fuel return solenoid valve, and the coil of the coil of the fuel indicator transfer relay. The return circuit is via circuits 79, 91 and 7. (Refer to figure 2-52).

To stop the engine, the fuel cut-off solenoid valve is energized by the fuel cut-off switch on the instrument panel. This circuit is always available regardless of the position of the master switch.

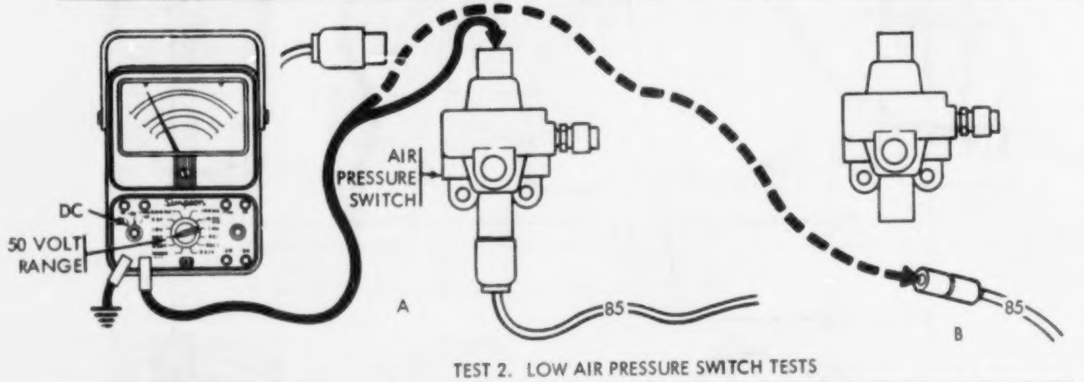
The current flows from the positive battery terminal, through circuit 6, 450 and 10, then circuit 54 through a circuit breaker, and continues via circuit 54 through the fuel cut-off switch, via circuit 54 to the fuel cut-off solenoid valve. The return circuit is through circuit 7 to the negative battery terminal. (Refer to figure 2-53.)

A test for the fuel pump is to turn the master switch to "ON" and listen at the fuel tank to determine that it is operating. On the XM757 truck, operate the fuel pump switch and check each fuel pump. To test the fuel cut-off solenoid valve, operate the fuel cut-off switch and listen for the actuation of the fuel cut-off solenoid.

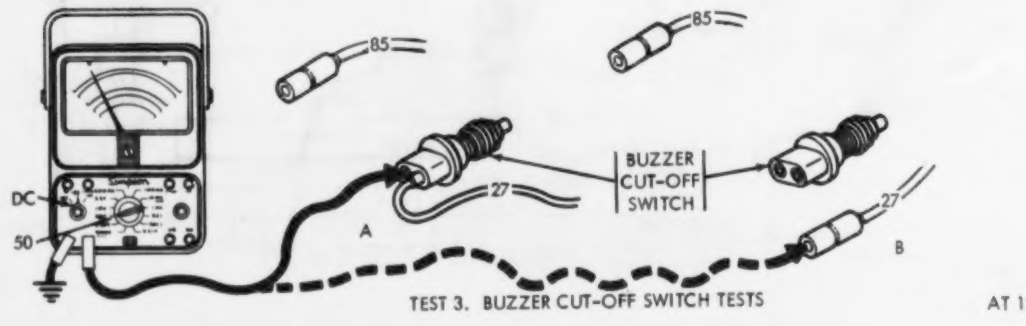

(M656 SHOWN)
LOW AIR PRESSURE CUTOFF SWITCH
LOW AIR PRESSURE SWITCH AND BUZZER UNDER PANEL ON BULKHEAD


WARNING BUZZER
CHECK GROUND HERE
DC
50
Simpson

TEST 1. LOW AIR PRESSURE WARNING BUZZER TEST


DC
50 VOLT RANGE
Simpson
AIR PRESSURE SWITCH
85
85
A
B

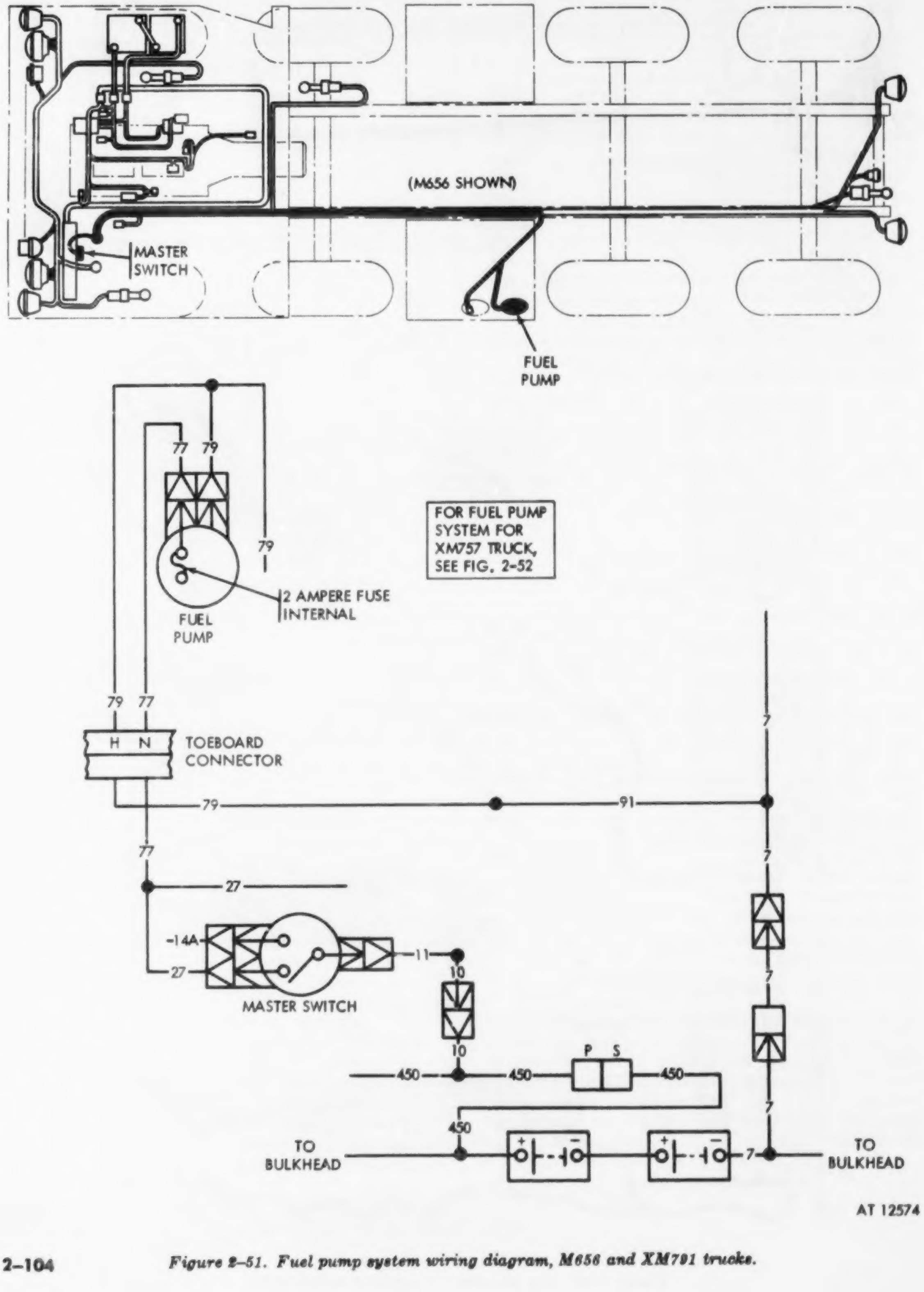
TEST 2. LOW AIR PRESSURE SWITCH TESTS


DC
50
Simpson
85
85
BUZZER CUT-OFF SWITCH
27
27
A
B

TEST 3. BUZZER CUT-OFF SWITCH TESTS

AT 12573

Figure 2-50. Low air pressure warning system tests.


(M656 SHOWN)
MASTER SWITCH
FUEL PUMP
77 79
79
FUEL PUMP
2 AMPERE FUSE INTERNAL
FOR FUEL PUMP SYSTEM FOR XM757 TRUCK, SEE FIG. 2-52
79 77
H N
TOEBOARD CONNECTOR
79
91
7
77
27
-14A
27
11
10
MASTER SWITCH
450
P S
TO BULKHEAD
TO BULKHEAD

AT 12574

Figure 2-51. Fuel pump system wiring diagram, M656 and XM791 trucks.

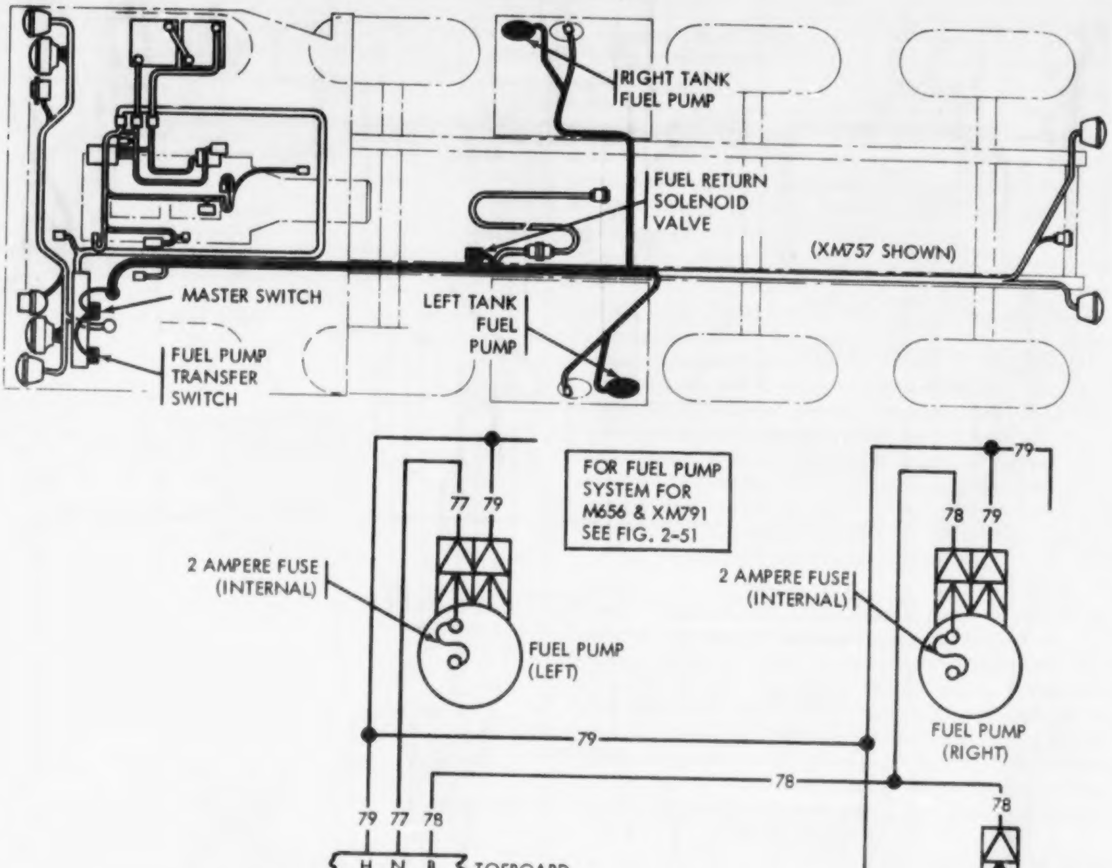

RIGHT TANK FUEL PUMP
FUEL RETURN SOLENOID VALVE
(XM757 SHOWN)
MASTER SWITCH
LEFT TANK FUEL PUMP
FUEL PUMP TRANSFER SWITCH
FOR FUEL PUMP SYSTEM FOR M656 & XM791 SEE FIG. 2-51
2 AMPERE FUSE (INTERNAL)
77
79
FUEL PUMP (LEFT)
2 AMPERE FUSE (INTERNAL)
78
79
FUEL PUMP (RIGHT)
79
78
78
79 77 78
H N B
TOEBOARD CONNECTOR
FUEL PUMP TRANSFER SWITCH
L
R
77
78
76
27
79
91
7
79
FUEL RETURN SOLENOID VALVE
TO FUEL INDICATOR TRANSFER RELAY COIL
14A
27
11
10
MASTER SWITCH
7
P S
10
6
68
TO BULKHEAD
TO BULKHEAD
AT 12575

Figure 2-52. Dual fuel pump system wiring diagram, XM757 truck.

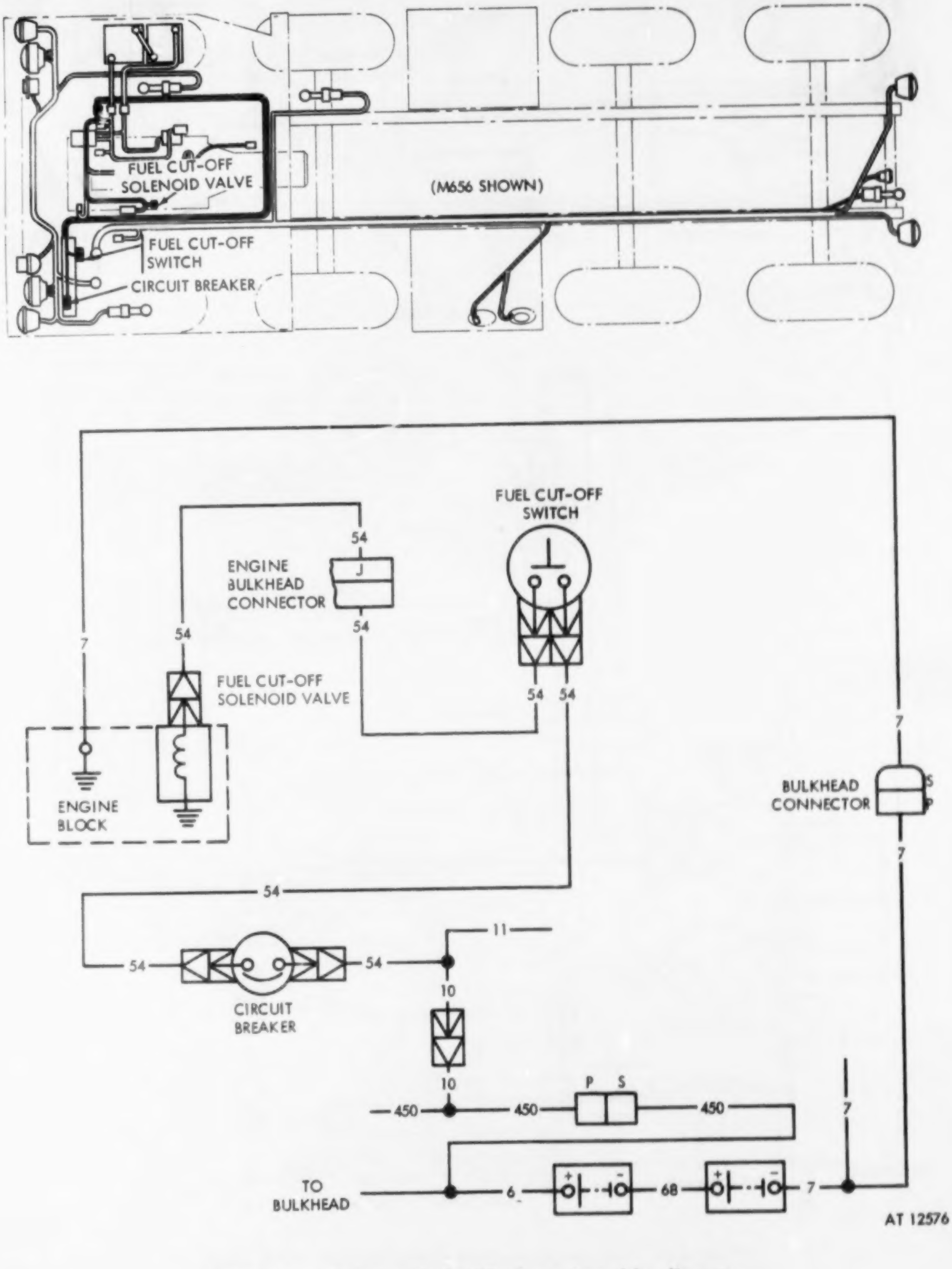

FUEL CUT-OFF SOLENOID VALVE
(M656 SHOWN)
FUEL CUT-OFF SWITCH
CIRCUIT BREAKER
FUEL CUT-OFF SWITCH
54
ENGINE BULKHEAD CONNECTOR
J
7
54
FUEL CUT-OFF SOLENOID VALVE
54 54
ENGINE BLOCK
BULKHEAD CONNECTOR
S
P
54
11
CIRCUIT BREAKER
10
450
P S
6
68
TO BULKHEAD
AT 12576

Figure 2-53. Fuel cut-off solenoid valve system wiring diagram.

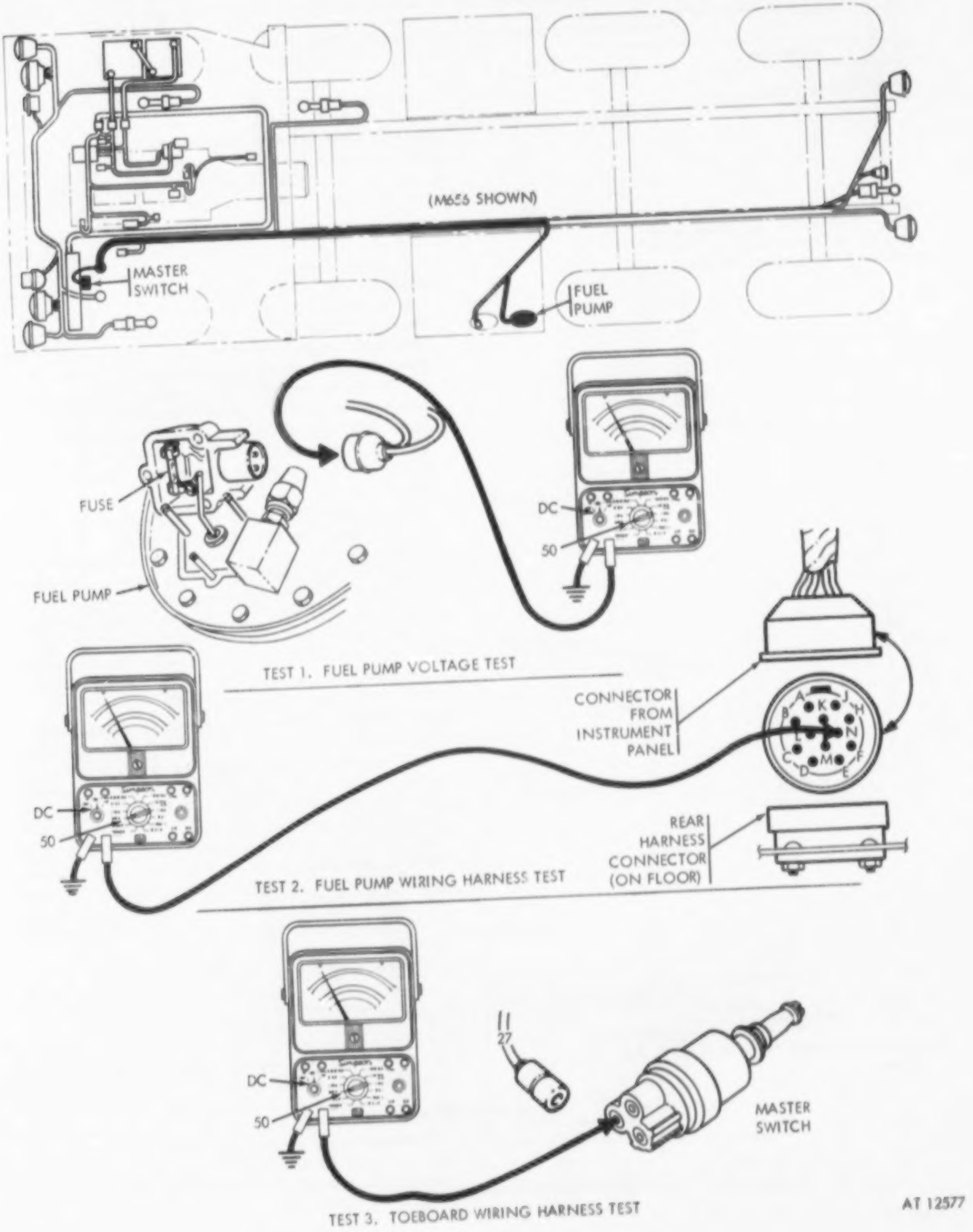
Table 2-5. Troubleshooting the Electrical System—Continued

FUEL PUMP SYSTEM CIRCUIT—Continued (Figure 2-54)

Malfunction	Circuit	Test
		Caution: **Be very careful when making electrical tests near the fuel tank. When components have been removed, cover the tank opening with tape or appropriate material. DO NOT PERMIT smoking, sparks, or open flame within 50 feet of vehicle and fuel tank when undergoing test and repair.**
Fuel pump does not operate. *Note.* Tests for the fuel pump system circuit for the XM757 truck are described separately. Refer to tests 5 and 6.	77, 79	Test 1. Perform fuel pump voltage test. Disconnect wire No. 77 at the fuel pump. Set up the multimeter for voltage tests (see fig. 2-9). Connect the voltmeter negative lead to the vehicle frame and the positive lead to the connector on wire No. 77, as shown in figure 2-54, test 1. Turn master switch to "ON" position. If 24 volts is indicated on voltmeter, check for loose or broken ground connection of wire No. 79 at fuel pump terminal or vehicle frame. If ground connection is satisfactory, remove fuse cover from top of pump and inspect the fuse. If the fuse is blown, replace fuse. Reconnect wire No. 77 and re-test the fuel pump. If the replacement fuse blows, replace the fuel pump.
	77, 79	Test 2. Perform fuel pump wiring harness test. If no or low voltage is indicated on wire No. 77 at fuel pump reconnect wire to fuel pump. Disconnect rear wiring harness connector (right hand) containing wire No. 77 at toeboard. Attach red voltmeter lead to socket terminal "N" and black test lead to vehicle ground, as shown in figure 2-54, test 2. If 24 volts is indicated on voltmeter, inspect main harness wiring from toeboard top connector to fuel pump for broken wire, loose or corroded connection.
	77, 79	Test 3. Perform toeboard wiring harness test. If no or low voltage is indicated at toeboard socket terminal "N", test for 24 volts at master switch terminal of wire No. 27. Disconnect wire No. 27 from its terminal on master switch, attach red voltmeter lead to exposed switch terminal and attach black test lead to vehicle ground, as shown in figure 2-54, test 3. If 24 volts is indicated, check main harness wiring to toeboard connector for broken wire, loose or corroded connection. If in voltage is indicated at master switch terminal of wire No. 27, refer to figure 2-19, test 3.

FUEL PUMP SYSTEM CIRCUIT—Continued (Figure 2-55)

Malfunction	Circuit	Test
Fuel cut-off solenoid valve does not operate.	54	Test 4. Perform fuel cut-off solenoid system voltage test. Remove wire No. 54 at fuel cut-off solenoid. Set up the multimeter for voltage tests (fig. 2-9). Connect the black test lead to the vehicle frame. With the red test lead, check for 24 volts on the connector just removed when switch is actuated, as shown in figure 2-55, test 4A. If 24 volts is measured, the sole-


(M656 SHOWN)
MASTER SWITCH
FUEL PUMP
FUSE
FUEL PUMP
DC
50
CONNECTOR FROM INSTRUMENT PANEL
A
K
J
B
H
N
L
C
M
F
D
E
DC
50
REAR HARNESS CONNECTOR (ON FLOOR)
DC
50
11
27
MASTER SWITCH
AT 12577

TEST 1. FUEL PUMP VOLTAGE TEST

TEST 2. FUEL PUMP WIRING HARNESS TEST

TEST 3. TOEBOARD WIRING HARNESS TEST

Figure 2-54. Fuel pump system tests.

Table 2-5. Troubleshooting the Electrical System—Continued

FUEL PUMP SYSTEM CIRCUIT—Continued (Figure 2-55)

Malfunction	Circuit	Test
		noid is faulty, replace solenoid. If 24 volts is not indicated on wire No. 54, remove both wires No. 54 at the fuel cut-off switch. Check for 24 volts on each of the wires just removed. If 24 volts is indicated on either of them, reconnect it to the switch. Actuate the switch and check for 24 volts at the other switch terminal. If 24 volts is not indicated, the switch is faulty. Replace the fuel cut-off switch. If 24 volts is indicated at the switch terminal, check wire No. 54 from the switch to the solenoid for breaks or loose connections. However, if neither switch wire indicated 24 volts, disconnect wire No. 54 from each terminal of 15-amp circuit breaker located in cab. Attach black voltmeter lead to vehicle ground. With red test lead check for 24 volts on each wire No. 54, as shown in figure 2-55, test 4C. If 24 volts is indicated on one of the two No. 54 wires, connect this wire to one terminal of circuit breaker. Connect red test lead to other terminal on circuit breaker. If 24 volts is indicated, circuit breaker is satisfactory. If no voltage is indicated replace circuit breaker. Check wire No. 54 from circuit breaker to fuel cut-off switch for corrosion or faulty connections. If 24 volts is not indicated on either wire No. 54 removed from the circuit breaker, check wire No. 54 from the circuit breaker to the junction with wire No. 10 for breaks or loose connections.

FUEL PUMP SYSTEM CIRCUIT—Continued (Figure 2-56)

Malfunction	Circuit	Test
		ADDITIONAL TEST FOR DUAL FUEL PUMP SYSTEM INSTALLED ON XM757 TRUCKS
Neither fuel pump operates or one fuel pump does not operate.	76, 77, 78	Test 5. Perform fuel pump switch voltage test. Remove wire No. 76 from fuel pump switch. Set up multimeter for voltage tests (see fig. 2-9). Turn master switch to "ON" position. Check for 24 volts on the connector just removed. If 24 volts is indicated, restore the connector to the switch, and remove wire No. 77 and 78 from the other two terminals of the switch. Check for voltage on switch terminals 77 and 78 for both positions of the switch. If 24 volts is not indicated on one of the terminals each time the switch is operated, the switch is faulty. Replace switch. If 24 volts is indicated when the switch is operated, use the procedure in figure 2-54, test 1 and 2 to check each fuel pump circuit. If 24 volts is not indicated on wire No. 76, check the wiring harness from the fuel pump switch to the master switch for breaks or loose connections. Repair as necessary.

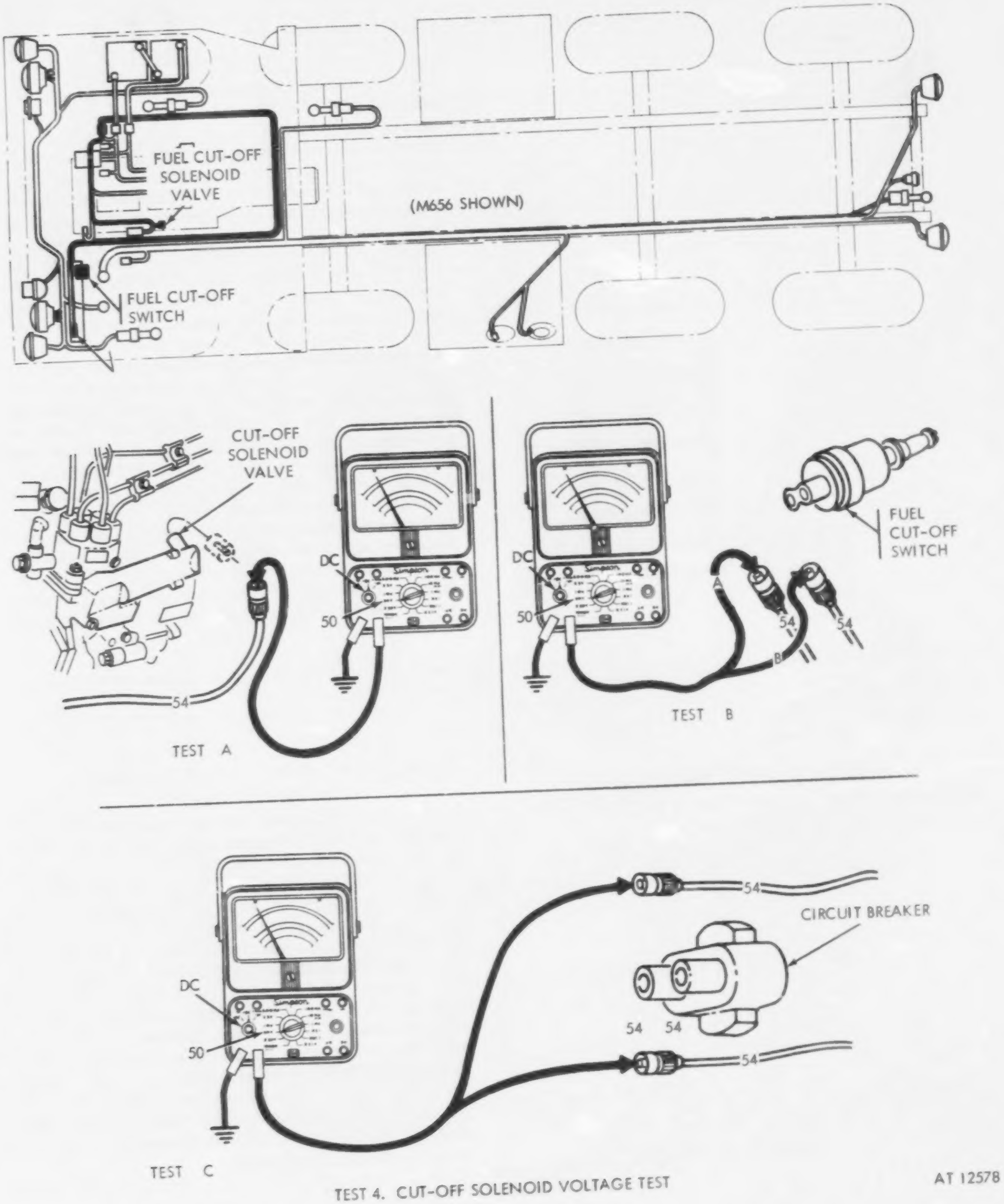
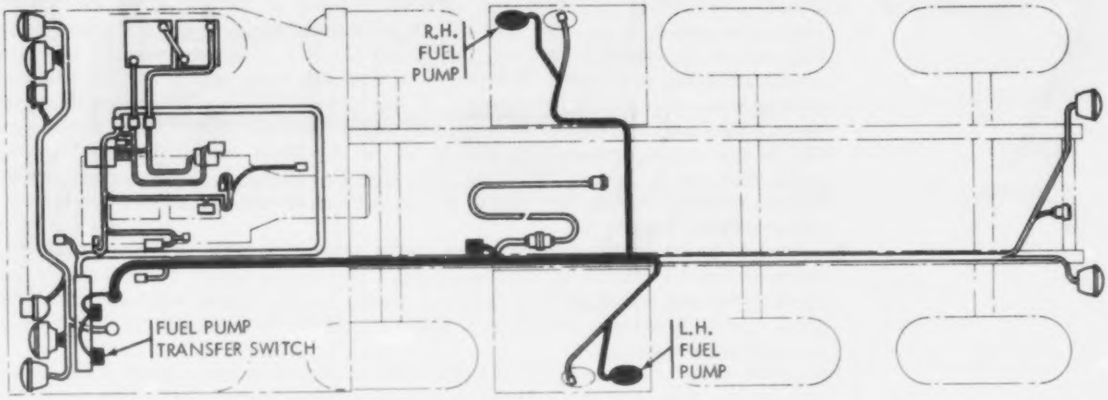
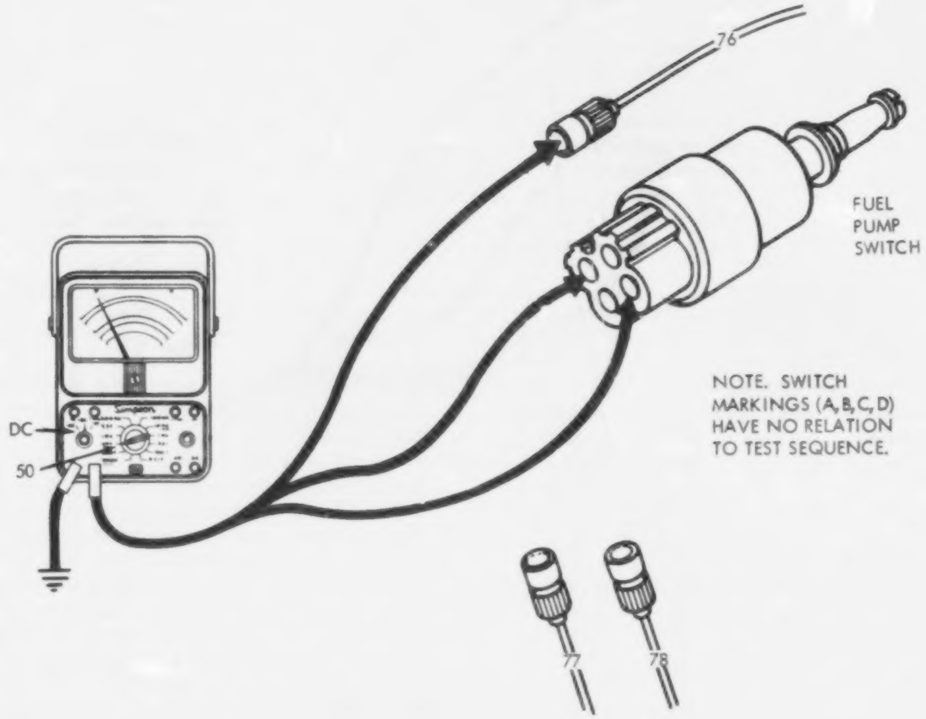

FUEL CUT-OFF
SOLENOID
VALVE
(M656 SHOWN)
FUEL CUT-OFF
SWITCH
CUT-OFF
SOLENOID
VALVE
DC
50
54
TEST A
DC
50
A
B
54
54
FUEL
CUT-OFF
SWITCH
TEST B
54
CIRCUIT BREAKER
DC
50
54 54
54
TEST C
TEST 4. CUT-OFF SOLENOID VOLTAGE TEST
AT 12578

Figure 2-55. Fuel cut-off solenoid valve tests.


R.H. FUEL PUMP
FUEL PUMP TRANSFER SWITCH
L.H. FUEL PUMP


76
FUEL PUMP SWITCH
DC
50
Simpson
77
78

NOTE. SWITCH MARKINGS (A, B, C, D) HAVE NO RELATION TO TEST SEQUENCE.

TEST 5. FUEL PUMP SWITCH VOLTAGE TESTS.

AT 12579

Figure 2-56. Dual fuel pump system tests.

Table 2-5. Troubleshooting the Electrical System—Continued

TRAILER INTERCONNECTING CABLE AND VAN CONNECTION SYSTEM (Figure 2-57)

DESCRIPTION: **The trailer connecting receptacle and cable is composed of two parts. On the XM757 truck, a receptacle is provided which is wired identical to the rear trailer receptacle mounted on all vehicles; however, this receptacle is a plug, whereas the standard trailer receptacle is a socket. In conjunction with this receptacle, a 20 foot interconnecting cable, with a socket at each end, is provided to connect to the trailer electrical system. This cable consists of 12 conductors wired "straight through" so that contact "A" at one end is connected to contact "A" at the other end, contact "B" at one end is connected to contact "B" at the other end. Therefore, whatever voltages appear at the receptacle contact will appear at the far end of the respective cable contact. Refer to figure 2-57.**

The circuits in the trailer receptacle and trailer connecting cable are connected to the truck electrical system so that corresponding lights on the trailer will light when the truck lights are turned on. For instance, trailer marker lights will light when the truck marker lights are turned on, trailer turn signals will operate when the truck turn signals operate.

An overall check of the trailer connecting cable system is to turn on the truck lights one set at a time, and check to see that corresponding trailer lights turn on at the same time.

The van body mounted on the XM791 truck has service clearance lights, blackout marker lights, and an auxiliary 24 volt power line for emergency interior lights connected to the truck electrical system. Four connectors are provided at the left rear of the truck to connect the van system to the truck system. Circuit 489 is connected to circuit 21 to provide power for the service clearance lights, circuit 590 is conected to circuit 24 to provide power for the blackout marker lights, and circuit 37A is connected to circuit 37 to provide 24-volt power to the van interior. The fourth connector is a ground connector to provide a return circuit to the vehicle frame.

An overall check of this system is to turn on the truck service clearance lights, and the truck blackout marker lights and check to see that the corresponding lights operate normally on the van body. Also, check the van interior to see that the 24-volt components operate normally.

TRAILER INTERCONNECTING CABLE AND VAN CONNECTION SYSTEM—Continued (Figure 2-58)

Malfunction	Circuit	Test
One or more lightnig systems do not function on the trailer (XM757 truck).	21, 23, 24, 37, 99, 22-460, 22-461	Test 1. **Perform trailer connecting receptacle voltage test. Set up multimeter for voltage tests (see fig. 2-9). Connect the black test lead to the vehicle frame. Set the light switch in the truck to turn on the lighting system which does not operate on the trailer. Touch the red test lead to the pin in the receptacle which corresponds to the lighting system to be tested, as shown in figure 2-58, test 1. If 24 volts is indicated, set up the multimeter for continuity tests (see fig. 2-12). Measure continuity between contacts "D" and the vehicle frame, and also contact "L" and the vehicle frame. If full continuity (zero ohms) is not indicated, check both wires No. 90 from the trailer receptacle to the vehicle frame for breaks or corroded connections. If ground continuity is satisfactory, perform the connecting cable continuity test (test 2, below). If 24 volts is not indicated on any lighting circuit pin, check the wiring harness from the trailer connecting receptacle to the main wiring harness junction point for breaks or loose connections.**

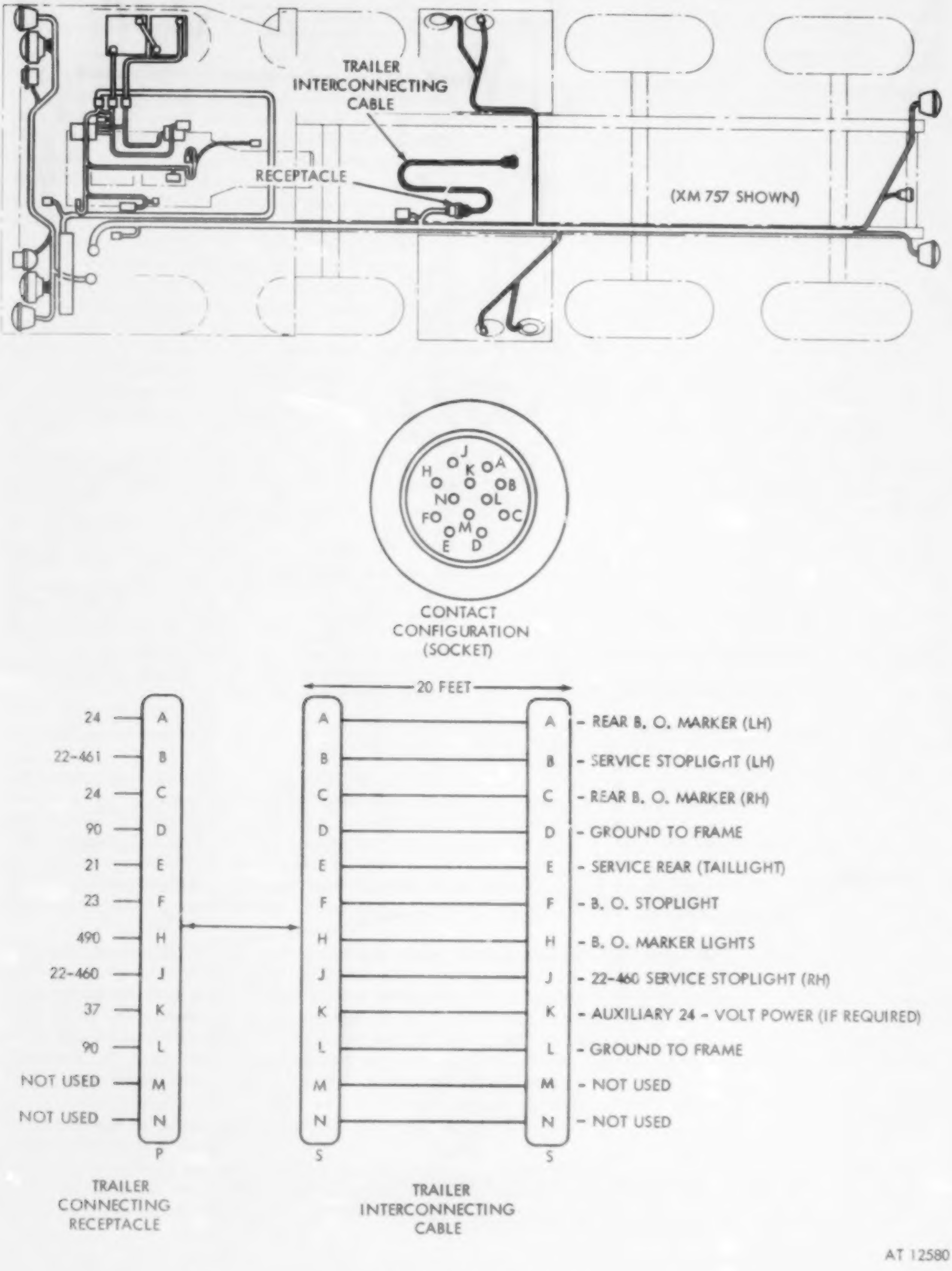

TRAILER INTERCONNECTING CABLE
RECEPTACLE
(XM 757 SHOWN)
J
H
K
A
B
N
L
F
C
M
E
D
CONTACT CONFIGURATION (SOCKET)
20 FEET
24 — A
22-461 — B
24 — C
90 — D
21 — E
23 — F
490 — H
22-460 — J
37 — K
90 — L
NOT USED — M
NOT USED — N
P
S
S
A - REAR B. O. MARKER (LH)
B - SERVICE STOPLIGHT (LH)
C - REAR B. O. MARKER (RH)
D - GROUND TO FRAME
E - SERVICE REAR (TAILLIGHT)
F - B. O. STOPLIGHT
H - B. O. MARKER LIGHTS
J - 22-460 SERVICE STOPLIGHT (RH)
K - AUXILIARY 24 - VOLT POWER (IF REQUIRED)
L - GROUND TO FRAME
M - NOT USED
N - NOT USED
TRAILER CONNECTING RECEPTACLE
TRAILER INTERCONNECTING CABLE
AT 12580

Figure 2-57. Trailer interconnecting cable system wiring diagram.

Table 2-5. Troubleshooting the Electrical System—Continued

TRAILER INTERCONNECTING CABLE AND VAN CONNECTION SYSTEM—Continued (Figure 2-58)

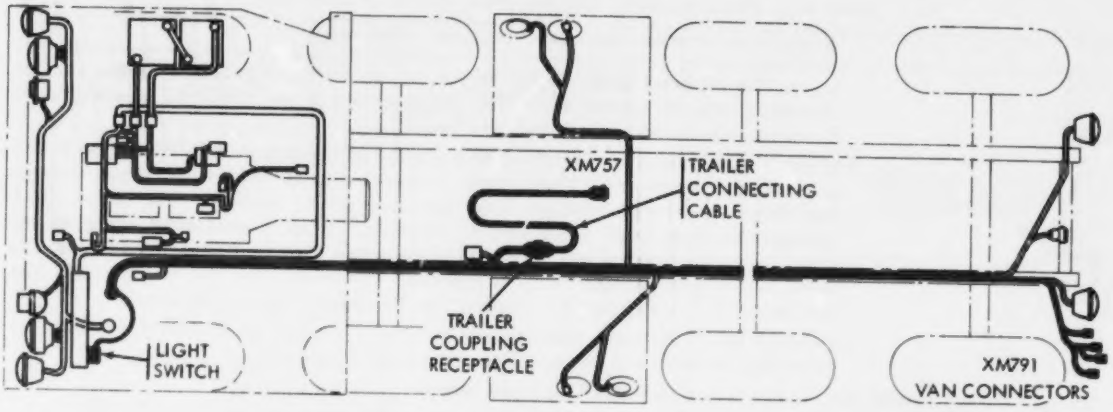
Malfunction	Circuit	Test
		Test 2. Perform trailer connecting cable continuity test. Set up multimeter for continuity tests (fig. 2-12). Remove the connecting cable from the truck and place both ends of the cable at a convenient point near each other. Open and lock the hinged covers at each end. Connect the black test lead to socket "A" at one end and touch the red test lead to socket "A" at the other end. Full continuity (zero ohms) should be indicated. Check each wire similarly, until all 12 have been checked. If any wire (except M and N, which are not in use) does not show continuity, repair or replace interconnecting cable. If all wires have continuity, plug the cable into the receptacle on the truck, and repeat test 1 (above) at the trailer end of the cable. If all voltages check normal, the trouble is in the trailer electrical system. Refer to the trailer technical manual for troubleshooting procedures.
Van blackout marker or service clearance lights do not function (XM791 truck)	37A, 489, 490	Test 3. Perform van connector voltage test. Set up multimeter for voltage tests (see fig. 2-9). Connect the black test lead to the vehicle frame. Set the truck light switch to turn on the faulty lighting system. With the red test lead, touch the connector corresponding to the faulty lighting system. If 24 volts is not indicated, check wires No. 489, 490 or 37A (as required) from the van connection to the junction with the truck wiring harness for breaks and corrosion. If 24 volts is indicated on the connectors, the trouble is in the van body wiring. Refer to van body electrical troubleshooting, figure 2-62.

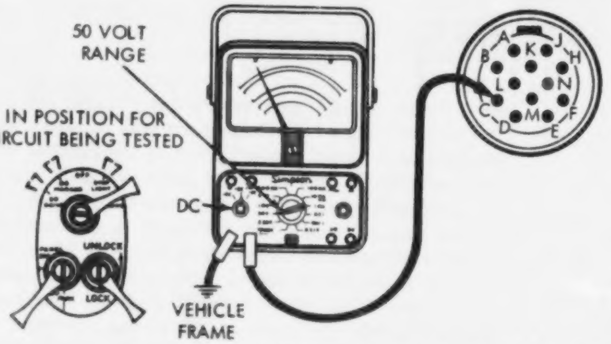
BILGE PUMP SYSTEM (Figure 2-59) (M656 Only)

DESCRIPTION: The bilge pump system is used only on the M656 truck, which is capable of swimming. The bilge pump system consists of four bilge pumps, connected in pairs to two switches. An indicator light is provided for each switch to show when the pumps have been turned on. Since the bilge pumps have a heavy current draw (20 amperes each) when they are pumping a full load of water, a relay circuit is provided to step up the alternator output capability to 80 amperes when the bilge pumps are in use. If the bilge pumps are not pumping to full capacity, the current draw will be considerably less.

Two facts must be remembered when troubleshooting this circuit. First, the bilge pumps and alternator are designed for operation under water in order to keep the operating temperature of the alternator to safe limits, and to keep the bilge pumps from running in a dry condition. Bilge pumps should not be operated any longer than necessary (5 minutes maximum). Second, the alternator relay is connected only to the cab bilge pump switch. If the cargo bilge pumps are operated alone, the alternator will not be switched to the higher output, with a resultant drain on the battery system.

The cab bilge pumps are energized by means of a double-pole switch on the instrument panel. When the switch is actuated, current flows from circuit 6 (positive battery) via circuit 450 through two 25-ampere circuit breakers (one for each pump) and then via circuit 450A through the cab bilge pump switch. From the switch, circuit 452L energizes the left cab bilge pump, and circuit 452R energizes the right cab bilge

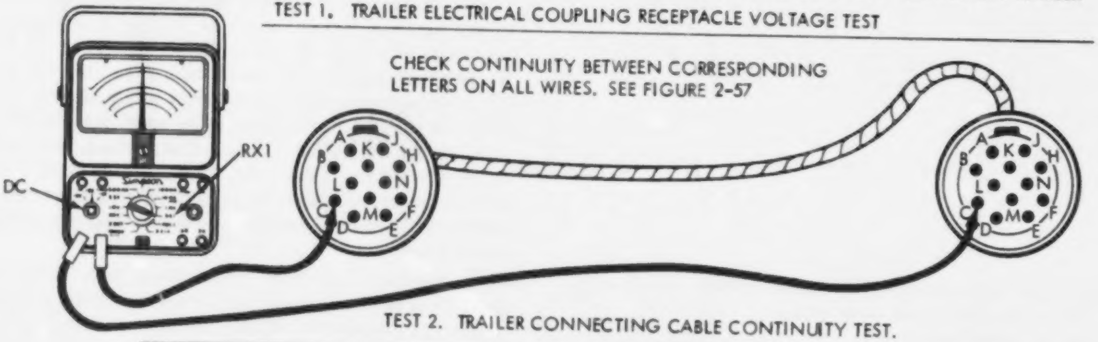

XM757
TRAILER CONNECTING CABLE
TRAILER COUPLING RECEPTACLE
LIGHT SWITCH
XM791
VAN CONNECTORS


50 VOLT RANGE
IN POSITION FOR CIRCUIT BEING TESTED
DC
VEHICLE FRAME
A
B
C
D
E
F
H
J
K
L
M
N

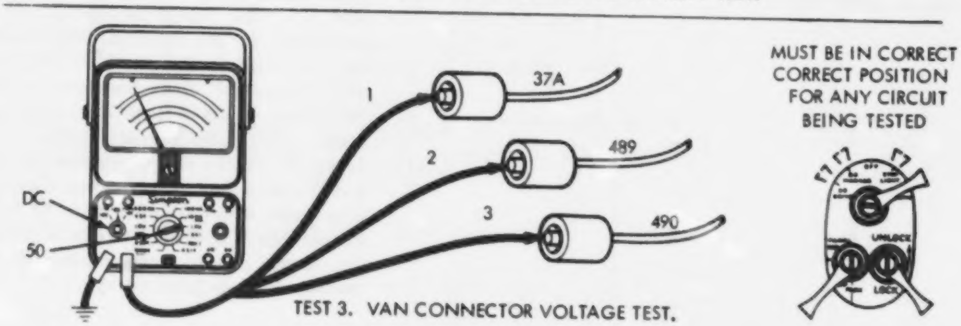
PIN	WIRE NO.	CIRCUIT
A	24	REAR B.O. MARKER (LH)
B	22-461	SERVICE STOPLIGHT (LH)
C	24	REAR B.O. MARKER (RH)
D	90	GROUND TO FRAME
E	21	SERVICE REAR LIGHT
F	23	B.O. STOPLIGHT
H	490	B.O. MARKER LIGHTS
J	22-460	SERVICE STOPLIGHT (RH)
K	37	AUXILIARY 24 VOLT POWER
L	90	GROUND TO FRAME
M	NONE	NOT USED
N	NONE	NOT USED

NOTE. REFER TO TRAILER MANUAL FOR TYPE AND LOCATION OF LIGHTS ON TRAILER

TEST 1. TRAILER ELECTRICAL COUPLING RECEPTACLE VOLTAGE TEST


CHECK CONTINUITY BETWEEN CORRESPONDING LETTERS ON ALL WIRES. SEE FIGURE 2-57
RX1
DC
A
B
C
D
E
F
H
J
K
L
M
N

TEST 2. TRAILER CONNECTING CABLE CONTINUITY TEST.


DC
50
1
37A
2
489
3
490

MUST BE IN CORRECT CORRECT POSITION FOR ANY CIRCUIT BEING TESTED

TEST 3. VAN CONNECTOR VOLTAGE TEST.

AT 12581

Figure 2-58. Trailer and van interconnecting cable tests.

Table 2-5. Troubleshooting the Electrical System—Continued

BILGE PUMP SYSTEM—Continued (Figure 2-59) (M656 Only)

pump. The indicator lamp, located in the cab, is energized by circuit 452L, and the alternator relay by circuit 452R. The return circuit is via circuit 91 to circuit 7 to the negative battery terminal. Refer to figure 2-59.

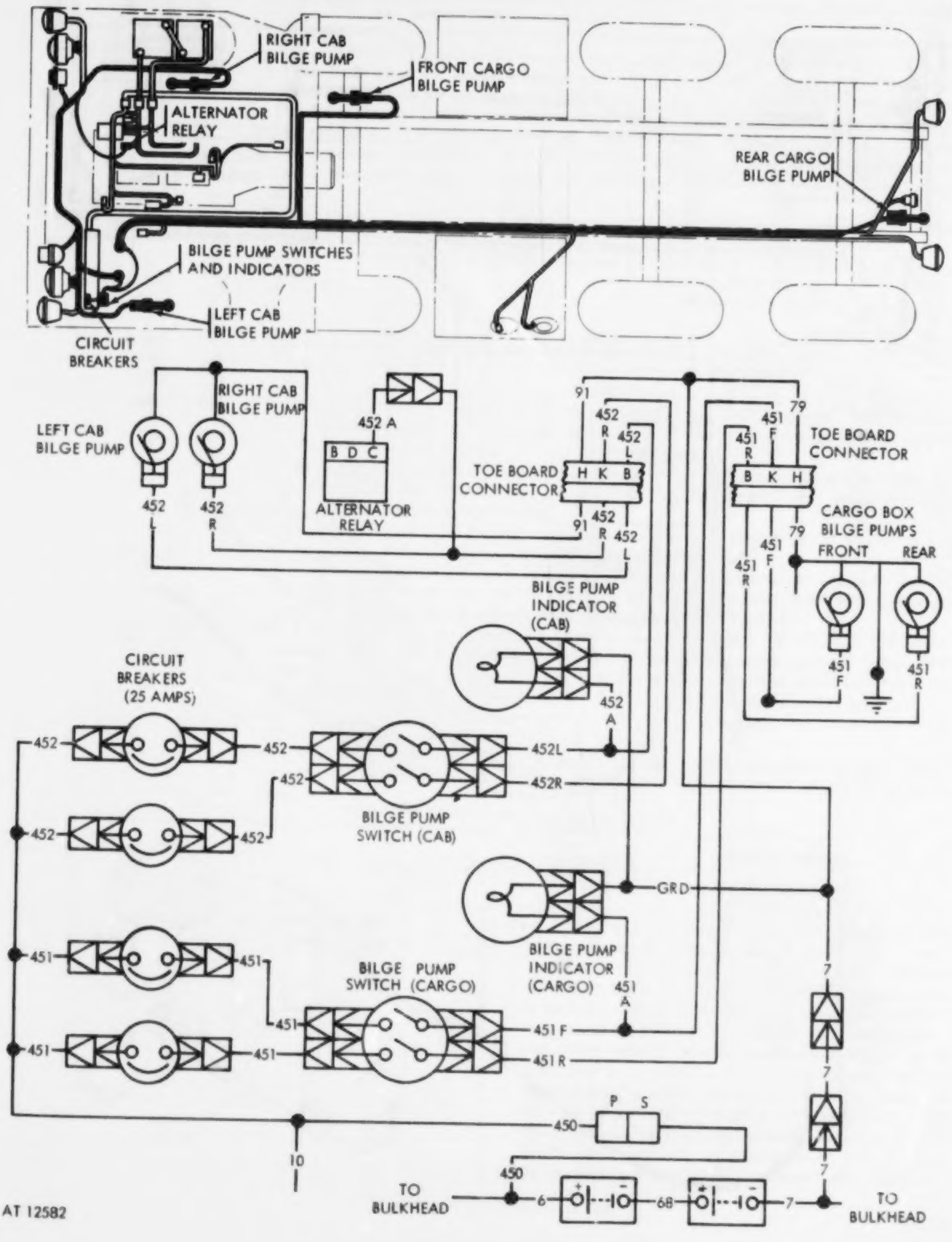
The cargo bilge pumps are energized by a similar double-pole switch. When this switch is actuated, current flows from circuit 6 (positive battery) via circuit 450 through two 25-ampere circuit breakers (one for each pump) and then via circuit 450A through the cargo bilge pump switch. From the switch, circuit 451F energizes the front cargo bilge pump, and circuit 451R energizes the rear cargo bilge pump. The cargo bilge pump indicator lamp is energized by circuit 451F via circuit 451A. The return circuit is via circuit 91 to circuit 7 to the negative battery terminal.

An overall test of the bilge pump system is to turn on each set of pumps and make an individual inspection to see that they are operating properly.

Caution: **Do not operate the system in dry air more than 2 to 3 minutes.**

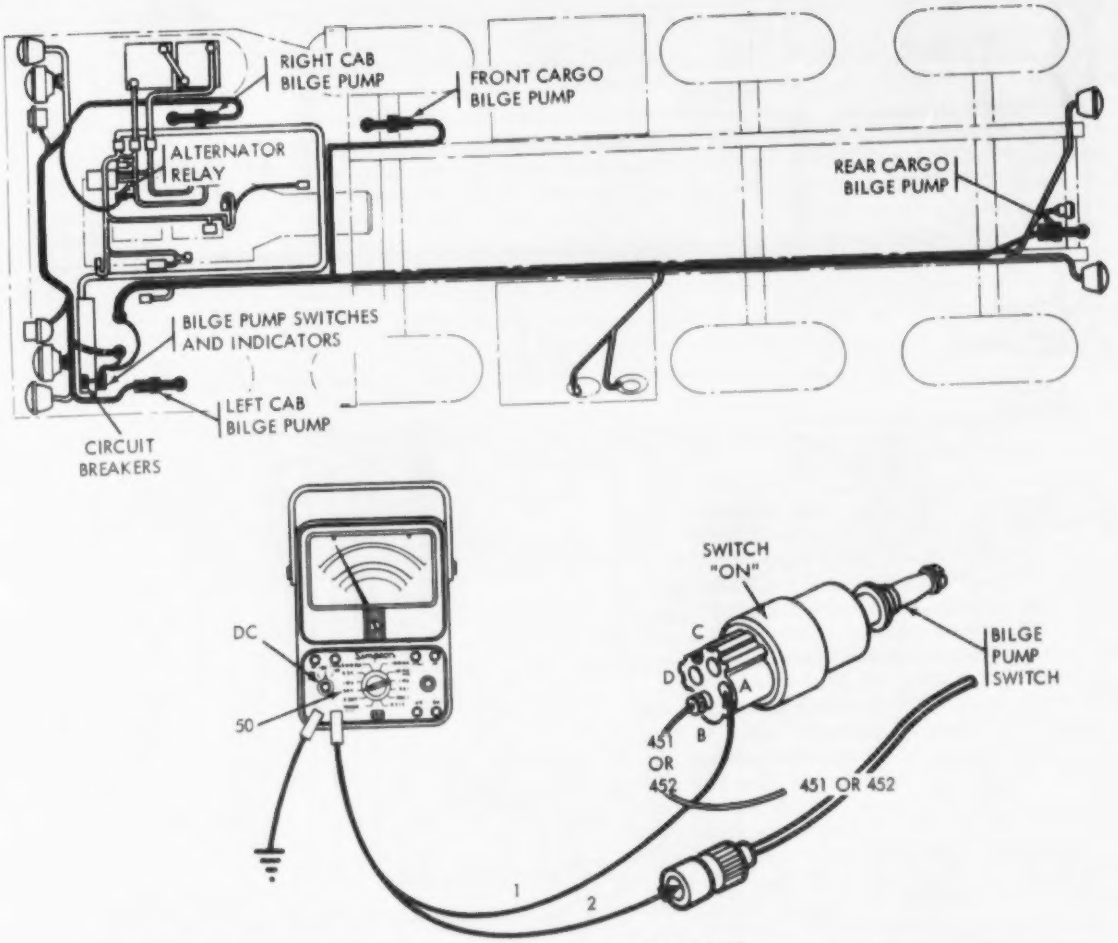
BILGE PUMP SYSTEM—Continued (Figure 2-60) (M656 Only)

Malfunction	Circuit	Test
Bilge pump(s) and indicator(s) inoperative.	450A, 451R, 451F, 452R, 452L	Test 1. Perform the bilge pump switch voltage test. Set up the multimeter for voltage tests (see fig. 2-9). Dependent upon which pump circuit is inoperative, disconnect wire No. 452 (L or R) or 451 (R or F) from its associated bilge pump switch. Set the voltmeter to 50-volt range, attach red test lead to the exposed switch terminal and attach black test lead to vehicle ground, as shown in figure 2-60, test 1. Turn associated bilge pump switch to "ON" position. If a reading of 24 volts is indicated, check for corroded or faulty (broken-open circuit) electrical pump cable to switch terminal connection. If no voltage is indicated, reconnect wire No. 452 (L or R) or 451 (R or F) to its switch terminal and disconnect wire No. 451 or 452 from opposite terminal on bilge pump switch. Attach red test lead of voltmeter to receptacle (cable) end of wire No. 451 or 452 and attach black test lead to vehicle frame. Turn bilge pump switch "ON". If no voltage or less than 22 volts is indicated on voltmeter, bilge pump switch is faulty. Replace bilge pump switch.
Individual bilge pump inoperative (on either side of cab or at either end of cargo box).	451F, 451R, 452L, 452R	Test 2. Perform individual bilge pump test. Remove, from its electrical connection at malfunctioning bilge pump: (1) wire No. 451F (cargo box front), (2) wire No. 451R (cargo box rear), (3) wire No. 452L (cab left), or (4) wire No. 452R (cab right). Attach red test lead to receptacle (cable) end of removed wire and attach black test lead to vehicle frame. If no voltage or low voltage (less than 24 volts) is indicated, check cable harness wiring for broken wiring or open circuit; check harness wiring through toeboard connections. Use wiring diagram, figure 2-59, as a guide, in conjunction with the wiring harness diagram, figure 2-73. If 24 volts is indicated on voltmeter, check ground wire continuity (pump case to frame). Replace bilge pump.

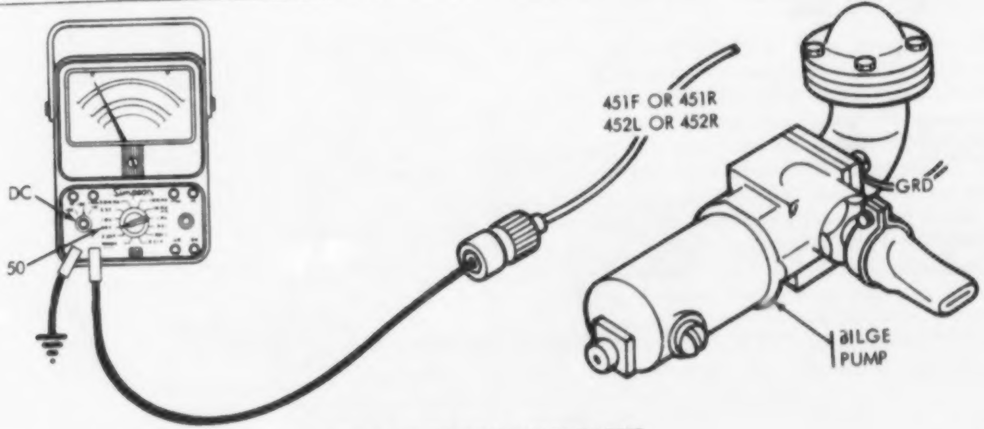

RIGHT CAB BILGE PUMP
FRONT CARGO BILGE PUMP
ALTERNATOR RELAY
REAR CARGO BILGE PUMP
BILGE PUMP SWITCHES AND INDICATORS
LEFT CAB BILGE PUMP
CIRCUIT BREAKERS
LEFT CAB BILGE PUMP
RIGHT CAB BILGE PUMP
452 A
B D C
ALTERNATOR RELAY
452 L
452 R
91
452 R
452 L
TOE BOARD CONNECTOR
H K B
91
452 R
452 L
451 R
451 F
79
TOE BOARD CONNECTOR
B K H
451 R
451 F
79
CARGO BOX BILGE PUMPS
FRONT
REAR
451 F
451 R
BILGE PUMP INDICATOR (CAB)
452 A
CIRCUIT BREAKERS (25 AMPS)
452
452
452L
452R
452
452
452
BILGE PUMP SWITCH (CAB)
GRD
BILGE PUMP INDICATOR (CARGO)
451 A
451
451
BILGE PUMP SWITCH (CARGO)
451
451
451
451 F
451 R
7
7
7
P S
450
450
10
TO BULKHEAD
6
68
7
TO BULKHEAD

AT 12582

Figure 2-59. Bilge pump system wiring diagram.


RIGHT CAB
BILGE PUMP
FRONT CARGO
BILGE PUMP
ALTERNATOR
RELAY
REAR CARGO
BILGE PUMP
BILGE PUMP SWITCHES
AND INDICATORS
LEFT CAB
BILGE PUMP
CIRCUIT
BREAKERS
SWITCH
"ON"
C
D
A
B
BILGE
PUMP
SWITCH
DC
50
451
OR
452
451 OR 452
1
2

TEST 1. BILGE PUMP SWITCH VOLTAGE TEST.


451F OR 451R
452L OR 452R
DC
50
GRD
BILGE
PUMP

TEST 2. BILGE PUMP VOLTAGE TEST.

AT 12583

Figure 2-60. Bilge pump system tests.

Table 2-5. Troubleshooting the Electrical System—Continued

VAN BODY SYSTEMS (Figure 2-61)

Malfunction	Circuit	Test

DESCRIPTION: The van body electrical systems are divided into AC and DC systems. The 24-volt DC system derives its power from the XM791 truck electrical system and supplies power for the clearance lights, blackout marker lights, interior emergency light, and the Pershing lights. The 208/120-volt AC system derives its power from an external power source (base power lines or auxiliary generator) and supplies the blackout lights, fluorescent lights, heaters, air conditioner, and power receptacles for equipment.

Each subsystem is treated as a separate system for troubleshooting, with a description of the system at the beginning of each test.

Refer to figure 2-61 for a schematic diagram of the complete wiring system of the van body.

VAN BODY 24-VOLT DC SYSTEMS CIRCUITS—Continued (Figure 2-62)

Malfunction	Circuit	Test

DESCRIPTION: The 24-volt DC systems are divided into four subsystems. Each system is individual and is not interconnected with any other system except at the point where the van system connects to the truck system.

The clearance light system is connected to circuit 489 of the truck connecting cable, and is connected around the van body to the left rear, left front, right front and right rear clearance lights, in that order.

The blackout marker light system is connected similarly to circuit 490 of the truck connecting cable, and follows the same path as circuit 489.

The interior emergency light starts at the circuit 37A connection at the truck connecting cable, then via circuit 37A to two switches. The emergency light switch supplies power from circuit 37A to circuit 37B, then to the emergency light.

The Pershing lights are turned on by the switch labeled "BLACKOUT LIGHT" mounted to the left of the emergency light switch. This switch supplies power from circuit 37A to circuit 37C, then to the four Pershing lights. This blackout circuit has no connection to the "BLACKOUT CIRCUIT" switch mounted directly above it.

The return circuits are all connected together in the van body and connected to the truck negative ground system by the GRD connector.

An overall check of the 24-volt DC system is to check that the connectors are plugged into the truck electrical system and turn on the various lights to verify their operation.

VAN BODY 24-VOLT DC SYSTEMS CIRCUITS (Figure 2-63)

Malfunction	Circuit	Test
Blackout marker and clearance lights inoperative.	489, 490	Test 1. Perform blackout marker and clearance light test. Put truck lighting switch in position corresponding to inoperative light system. If individual light is inoperative, replace lamp and check for loose or corroded socket. If complete set of lights is inoperative, set up multimeter for voltage tests (see fig. 2-9) and make voltage tests in sequence shown in figure 2-63, test 1. As soon as 24 volts is indicated at any check point, the item previously tested is faulty. If 24 volts is not indicated at truck connection, check truck harness and electrical system. Repair or replace faulty light assembly. If trouble is in the van body wiring harness, notify direct support maintenance.

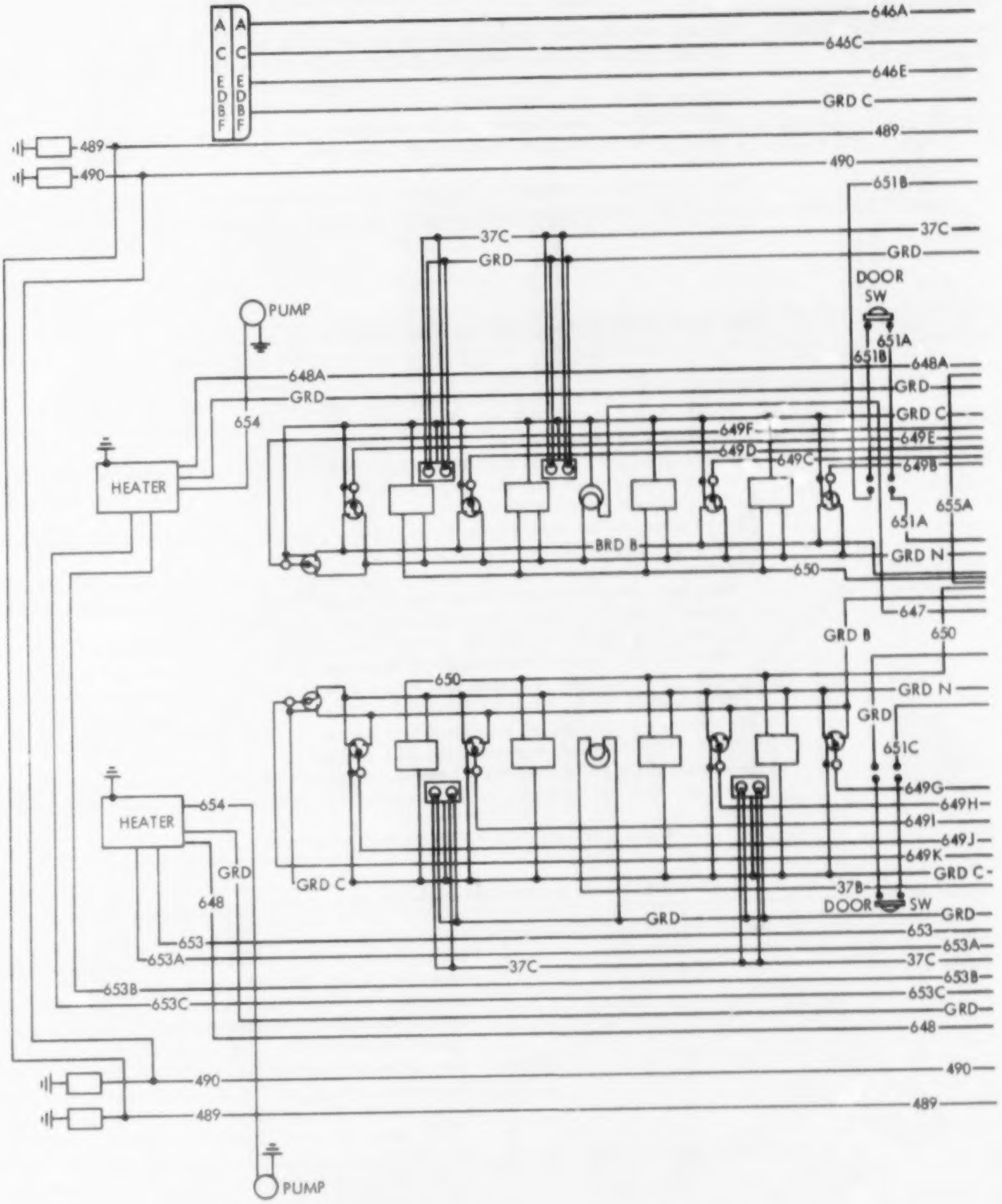
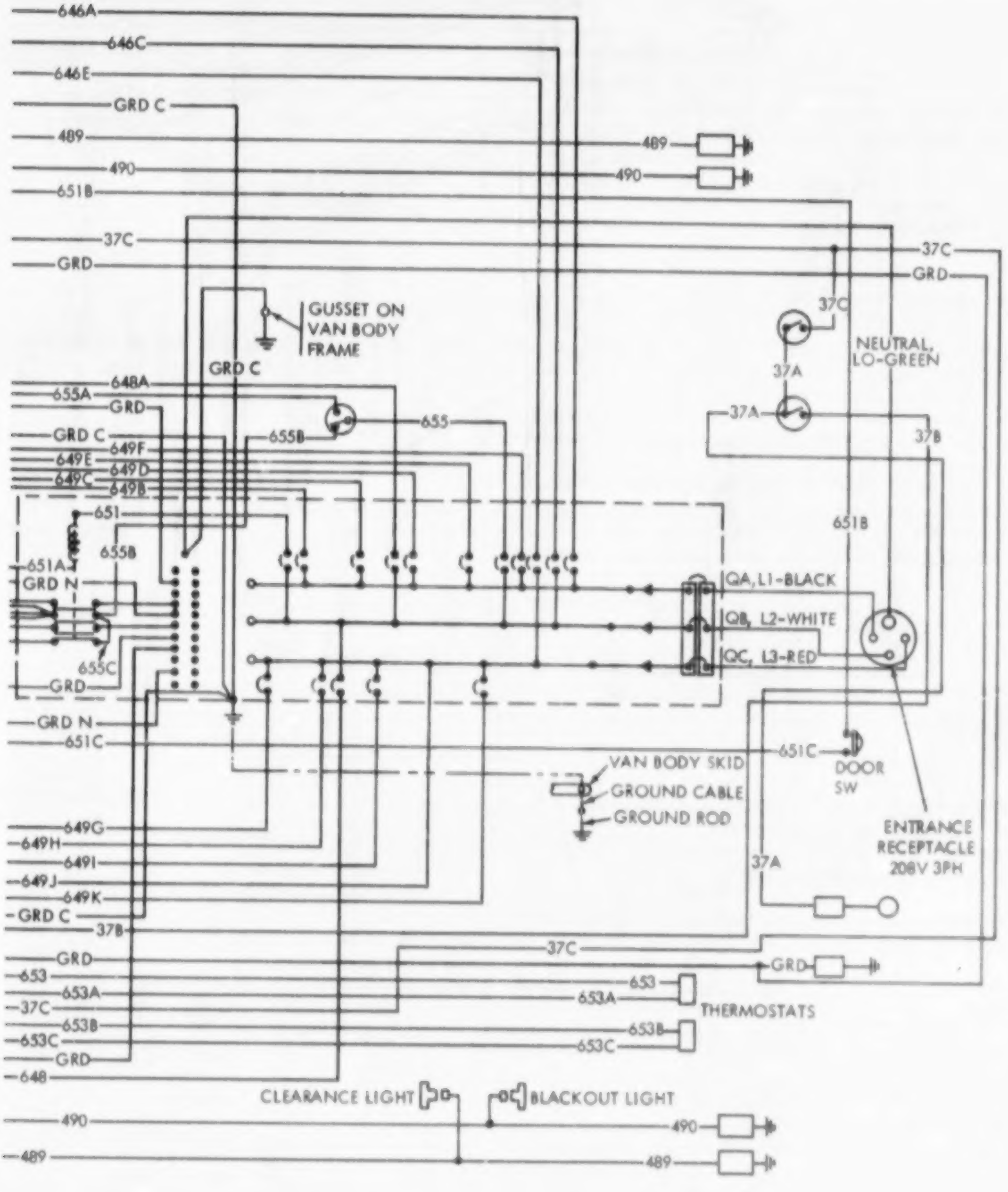
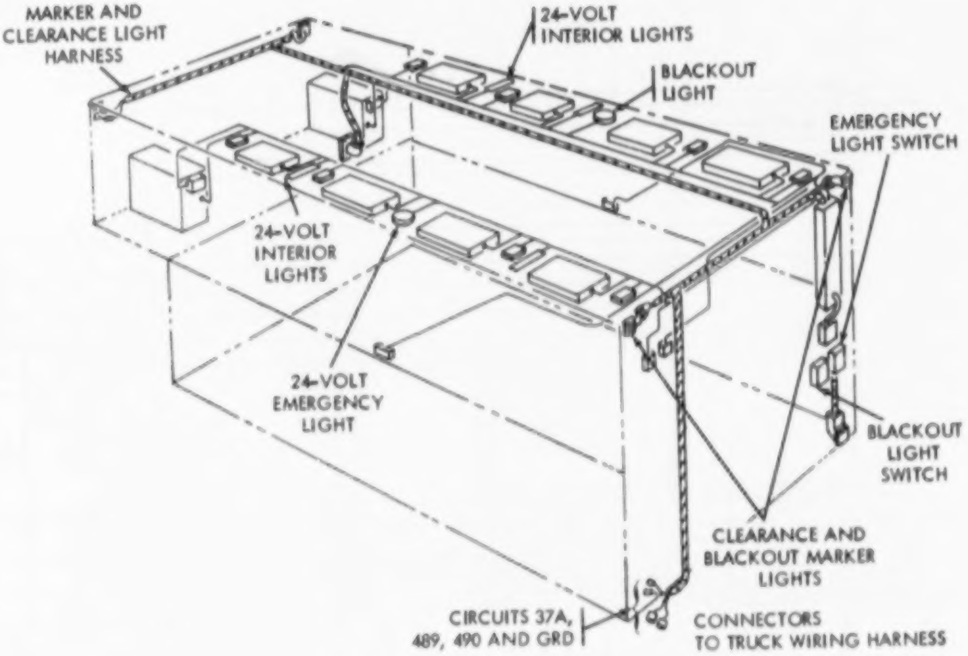

A
C
E
D
B
F
646A
646C
646E
GRD C
489
490
651B
37C
GRD
DOOR SW
651A
PUMP
648A
654
HEATER
649F
649D
649C
649E
649B
655A
BRD B
GRD N
650
647
GRD B
651C
649G
649H
649I
649J
649K
37B
648
653
653A
653B
653C

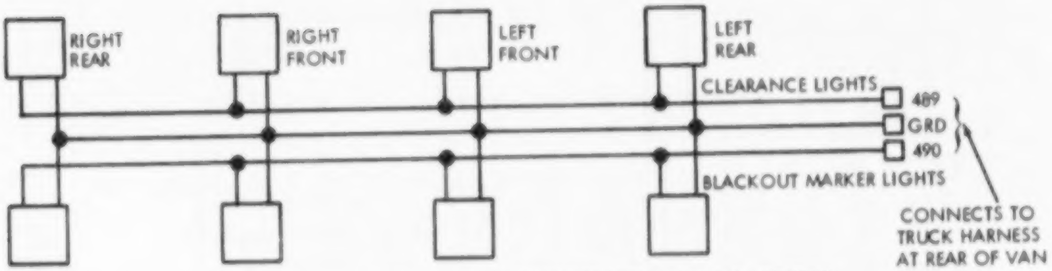
Figure 2-61. Van body schematic wiring diagram.


646A
646C
646E
GRD C
489
490
651B
37C
GRD
GUSSET ON
VAN BODY
FRAME
GRD C
648A
655A
GRD
655B
655
GRD C
649F
649E
649D
649C
649B
651
651A
GRD N
655B
655C
GRD
QA, L1-BLACK
QB, L2-WHITE
QC, L3-RED
37C
37A
37A
37B
NEUTRAL,
LO-GREEN
651B
GRD N
651C
651C
DOOR
SW
VAN BODY SKID
GROUND CABLE
GROUND ROD
ENTRANCE
RECEPTACLE
208V 3PH
649G
649H
649I
649J
649K
GRD C
37B
GRD
653
653A
37C
653B
653C
GRD
648
37C
GRD
653
653A
THERMOSTATS
653B
653C
CLEARANCE LIGHT
BLACKOUT LIGHT
490
489
490
489

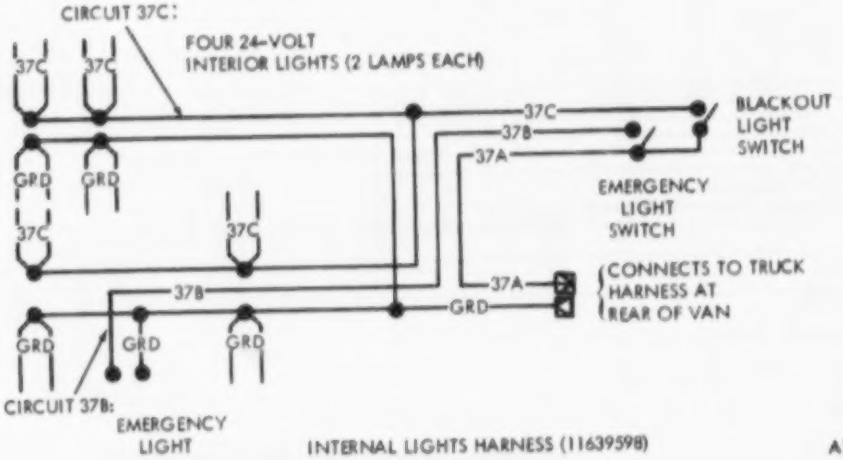
AT 12584

Figure 2-61. Van body schematic wiring diagram.


MARKER AND CLEARANCE LIGHT HARNESS
24-VOLT INTERIOR LIGHTS
BLACKOUT LIGHT
EMERGENCY LIGHT SWITCH
24-VOLT INTERIOR LIGHTS
24-VOLT EMERGENCY LIGHT
BLACKOUT LIGHT SWITCH
CLEARANCE AND BLACKOUT MARKER LIGHTS
CIRCUITS 37A, 489, 490 AND GRD
CONNECTORS TO TRUCK WIRING HARNESS


RIGHT REAR
RIGHT FRONT
LEFT FRONT
LEFT REAR
CLEARANCE LIGHTS
489
GRD
490
BLACKOUT MARKER LIGHTS
CONNECTS TO TRUCK HARNESS AT REAR OF VAN

MARKER AND CLEARANCE LIGHT HARNESS (7535589)


CIRCUIT 37C:
FOUR 24-VOLT INTERIOR LIGHTS (2 LAMPS EACH)
37C
37C
37C
37B
37A
BLACKOUT LIGHT SWITCH
GRD
GRD
37C
37C
EMERGENCY LIGHT SWITCH
37A
CONNECTS TO TRUCK HARNESS AT REAR OF VAN
37B
GRD
GRD
GRD
GRD
CIRCUIT 37B: EMERGENCY LIGHT

INTERNAL LIGHTS HARNESS (11639598)

AT 12585

Figure 2-62. 24-volt dc system wiring diagram.

Table 2–5. Troubleshooting the Electrical System—Continued

VAN BODY 24-VOLT DC SYSTEMS CIRCUITS—Continued (Figure 2–63)

Malfunction	Circuit	Test
Individual light inoperative.	37B, 37C GRD	Test 2. Perform light and switch circuit voltage test. *Note.* This test covers all light-and-switch combinations where one or two lights are operated by a single switch. Remove lamp from socket and check for corroded or dirty socket and contacts. Install tested lamp and turn on switch. If lamp does not light, disconnect both wires from the light assembly. Set up the multimeter for DC voltage (see fig. 2–9). If 24 volts is indicated, light socket is faulty. Replace light socket. If 24 volts is not indicated on the wires make voltage tests in sequence shown in figure 2–63, test 2. If harness is at fault, contact direct support maintenance personnel if replacement is required.
All 24-volt lights in van body inoperative.	37A, 37B, 37C, GRD	Test 3. Perform 24-volt DC system test. Disconnect wire No. 37A connector from the truck harness. Set up the multimeter for voltage tests (see fig. 2–9). Connect the black test lead to the truck frame and measure the voltage at the No. 37A connector on the truck harness. If 24 volts is not indicated, troubleshoot the truck harness (see fig. 2–58). If 24 volts is indicated, reconnect the No. 37 connector to the truck harness, and inspect any exposed wiring for breaks or loose connections. Contact direct support maintenance unit to assist in checking out the van body wiring harness.

VAN BODY 120/208-VOLT AC SYSTEM CIRCUITS (Figure 2–64)

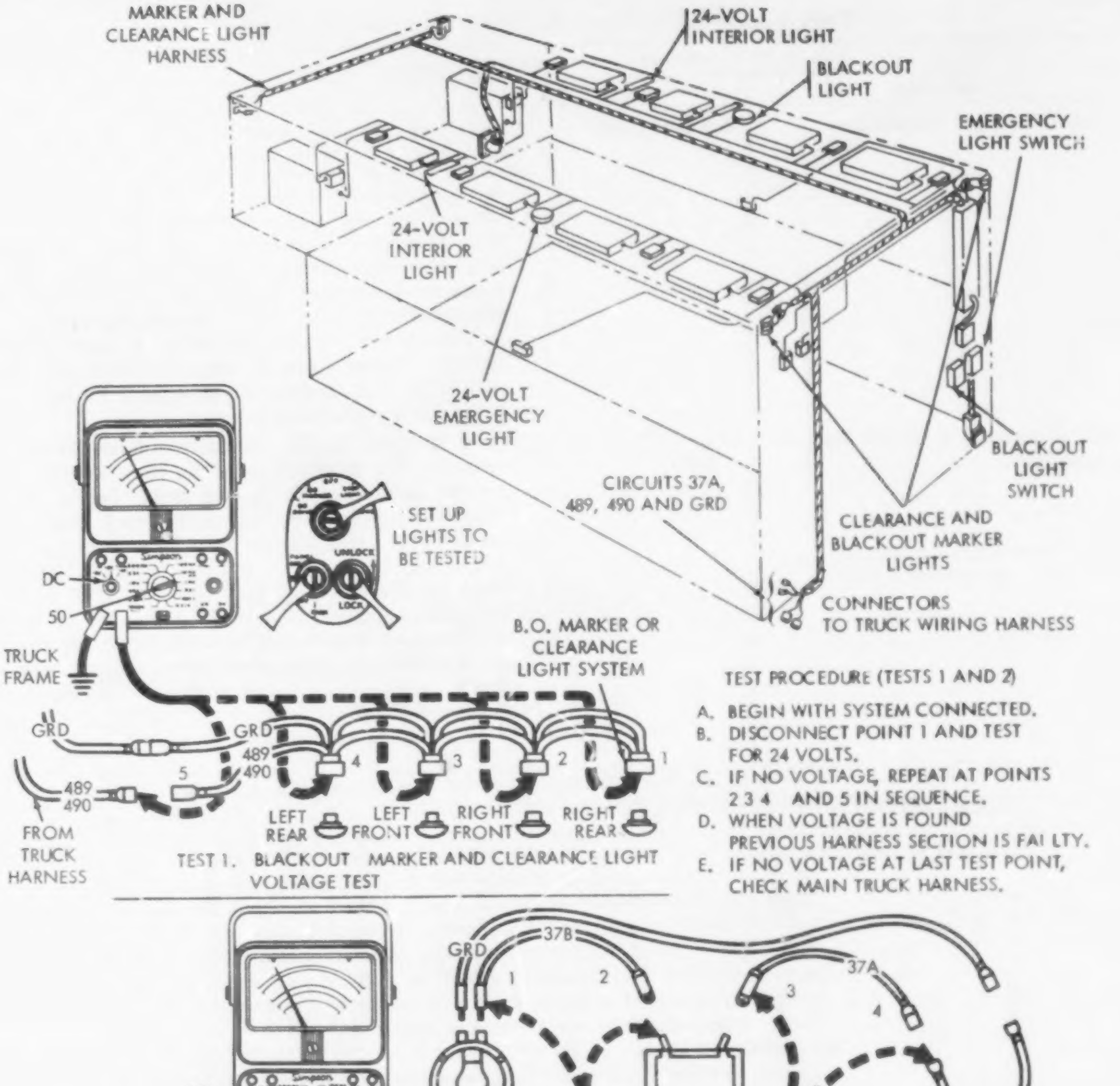
Malfunction	Circuit	Test

DESCRIPTION: The 120/208-volt, 3-phase, 60-cycle system, powered from an external source is used directly to furnish power to the 208-volt air conditioner unit, and is split into three single phases of 120 volts to furnish power to three groups of five circuits each in the 120-volt circuit breaker box. Each group of circuit breakers is used to supply power to various items of auxiliary equipment mounted permanently in the van body, as well as additional equipment installed for tactical purposes. Connection to the van body is by means of a 4-wire cable and connector plugged into the power cable entrance receptacle at the rear of the van body.

An overall test of the 120/208-volt system is to supply external power to the power entrance receptacle and operate all switches and circuit breakers to verify that all equipment is operating normally.

VAN BODY 120/208-VOLT AC SYSTEM CIRCUITS (Figure 2–65)

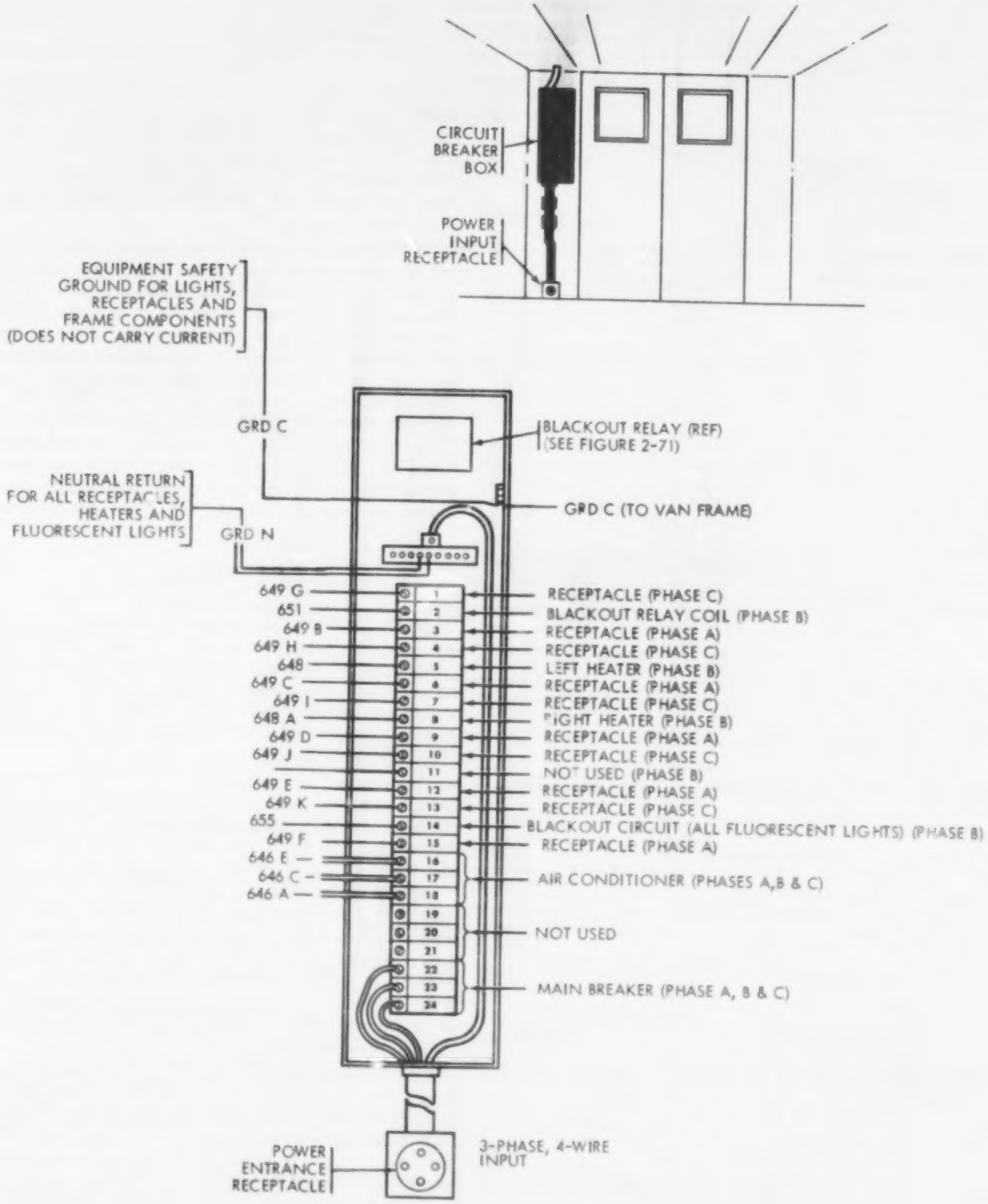
Malfunction	Circuit	Test
		***Warning:* The voltages present in the 120-volt system can cause severe or fatal electrical shock. Tests on the 120-volt system should be performed only by properly trained personnel.**
Fluorescent lamps, start slowly, blink, flicker, glow dimly, or otherwise not satisfactory, but incandescent lamp operates normally.	650, GRD	Test 1. Perform fluorescent lamp observation test. Troubles in fluorescent lights can be diagnosed more easily by careful visual observation than by voltage tests. Turn on light switch and observe whether lamp starts slowly, blinks but does not start, glows at ends


MARKER AND CLEARANCE LIGHT HARNESS
24-VOLT INTERIOR LIGHT
BLACKOUT LIGHT
EMERGENCY LIGHT SWITCH
24-VOLT INTERIOR LIGHT
24-VOLT EMERGENCY LIGHT
CIRCUITS 37A, 489, 490 AND GRD
BLACKOUT LIGHT SWITCH
CLEARANCE AND BLACKOUT MARKER LIGHTS
CONNECTORS TO TRUCK WIRING HARNESS
SET UP LIGHTS TO BE TESTED
UNLOCK
LOCK
DC
50
TRUCK FRAME
B.O. MARKER OR CLEARANCE LIGHT SYSTEM
GRD
GRD
489
490
489
490
5
4
3
2
1
FROM TRUCK HARNESS
LEFT REAR
LEFT FRONT
RIGHT FRONT
RIGHT REAR
TEST 1. BLACKOUT MARKER AND CLEARANCE LIGHT VOLTAGE TEST
DC
50
TRUCK FRAME
GRD
37B
1
2
3
37A
4
LIGHT
OFF
ON
24-VOLT LIGHT SWITCH
37A
GRD
FROM TRUCK HARNESS
TEST 2. LIGHT AND SWITCH CIRCUIT VOLTAGE TEST
DC
50
37A
INSPECT FOR BREAKS
GRD
FROM TRUCK HARNESS
37A
GRD
IF NO VOLTAGE ALSO CHECK TRUCK FRAME
TEST 3. 24 VOLT DC SYSTEM TEST.
AT 12586

TEST PROCEDURE (TESTS 1 AND 2)

A. BEGIN WITH SYSTEM CONNECTED.
B. DISCONNECT POINT 1 AND TEST FOR 24 VOLTS.
C. IF NO VOLTAGE, REPEAT AT POINTS 2 3 4 AND 5 IN SEQUENCE.
D. WHEN VOLTAGE IS FOUND PREVIOUS HARNESS SECTION IS FAULTY.
E. IF NO VOLTAGE AT LAST TEST POINT, CHECK MAIN TRUCK HARNESS.

Figure 2-63. Van body 24-volt DC systems tests.


CIRCUIT BREAKER BOX
POWER INPUT RECEPTACLE
EQUIPMENT SAFETY GROUND FOR LIGHTS, RECEPTACLES AND FRAME COMPONENTS (DOES NOT CARRY CURRENT)
GRD C
BLACKOUT RELAY (REF) (SEE FIGURE 2-71)
NEUTRAL RETURN FOR ALL RECEPTACLES, HEATERS AND FLUORESCENT LIGHTS
GRD N
GRD C (TO VAN FRAME)
649 G
651
649 B
649 H
648
649 C
649 I
648 A
649 D
649 J
649 E
649 K
655
649 F
646 E
646 C
646 A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
RECEPTACLE (PHASE C)
BLACKOUT RELAY COIL (PHASE B)
RECEPTACLE (PHASE A)
RECEPTACLE (PHASE C)
LEFT HEATER (PHASE B)
RECEPTACLE (PHASE A)
RECEPTACLE (PHASE C)
RIGHT HEATER (PHASE B)
RECEPTACLE (PHASE A)
RECEPTACLE (PHASE C)
NOT USED (PHASE B)
RECEPTACLE (PHASE A)
RECEPTACLE (PHASE C)
BLACKOUT CIRCUIT (ALL FLUORESCENT LIGHTS) (PHASE B)
RECEPTACLE (PHASE A)
AIR CONDITIONER (PHASES A,B & C)
NOT USED
MAIN BREAKER (PHASE A, B & C)
POWER ENTRANCE RECEPTACLE
3-PHASE, 4-WIRE INPUT

AT 12587

Figure 2-64. Van body 120/208-volt AC system wiring diagram.

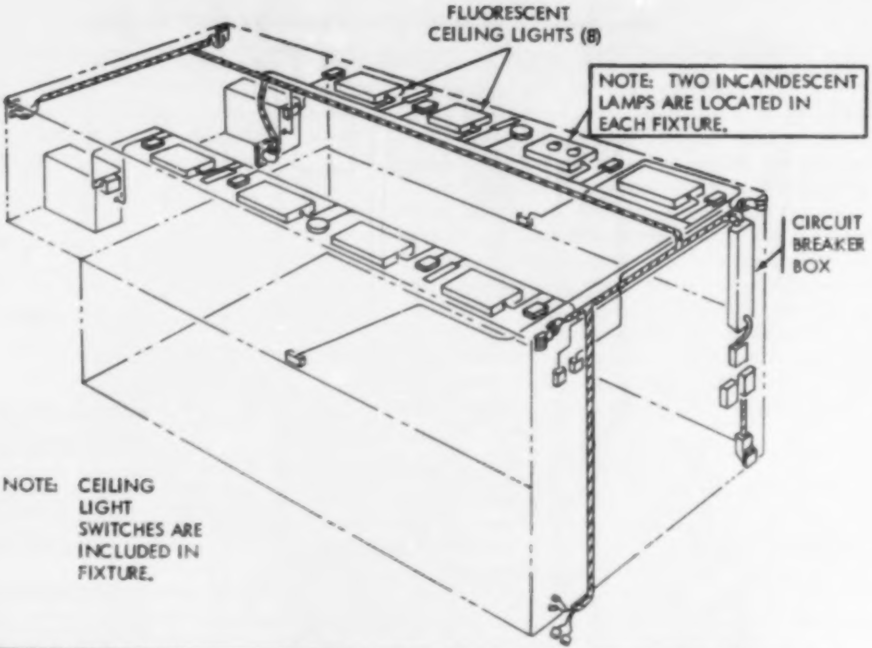
Table 2-5. Troubleshooting the Electrical System—Continued

VAN BODY 120/208-VOLT AC SYSTEM CIRCUITS—Continued (Figure 2-65)

Malfunction	Circuit	Test
		but does not blink, starts but is dim or has black spots, or has large blackened areas at one or both ends. Refer to figure 2-65, test 1, for a list of symptoms, causes and remedies for the listed observed malfunctions. If voltage, temperature, starter and lamp are normal and malfunction continues, entire light fixture is faulty.
Neither fluorescent nor incandescent lamps operate.	650, GRD	Test 2. Perform fluorescent lamp system voltage test. Set up the multimeter for AC voltage tests (see fig. 2-10). Turn off light circuit breaker. Remove lamp from socket and check for corroded or dirty socket and contacts. Install another lamp and turn on circuit breaker and switch. If replacement lamp does not light, turn off circuit breaker, remove light from ceiling and disconnect both No. 650 and GRD wires. Connect voltmeter as shown in figure 2-65, test 2. Turn on circuit breaker. If 120 volts is not indicated, check van wiring harness for broken wires or loose connections. Notify direct support maintenance personnel to assist in checking out van wiring harness.

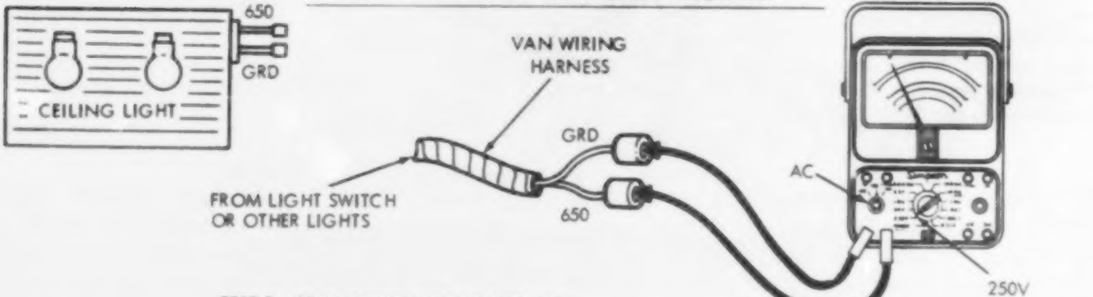
VAN BODY 120/208-VOLT AC SYSTEM CIRCUITS—Continued (Figure 2-66)

Malfunction	Circuit	Test
		Note. The 120/208 volts, 4-wire, three-phase electrical system used on the van body will normally indicate 115 to 120 volts between the green (or ground) wire and each one of the black, red or white wires. However, the voltage between any two of the black, red or white wires will be only 205 to 210 volts instead of double the individual leg voltage as in single phase circuits.
Air conditioner unit inoperative.	646A, 646C, 646E, GND	Test 1. Perform air conditioner input voltage test. Remove cover from circuit breaker box. Connect voltmeter and make voltage tests as shown in figure 2-66, test 1. Observe that the wires are connected to proper terminals from incoming power receptacles all the way through to air conditioner unit. Interchanging any two wires (red, black or white) will reverse the phase and cause any three-phase motor in the air conditioner to run backwards! This condition cannot be detected with a voltmeter. Figure 2-66, test 1, shows the correct connections. If connections and voltages are normal and air conditioner will not function, notify a direct support maintenance unit.
Some circuits receive power others inoperative.	Incoming Power Cable	Test 2. Perform 120-volt circuit breaker voltage test. Open cover on 120-volt circuit breaker box. Refer to figure 2-66, test 2, and note that the circuit breakers are divided into three groups of five breakers, with each group receiving power from a separate leg of the three-phase supply source. If a complete group of breakers is inoperative, make voltage measurements and inspect the wiring for that particular leg. If a single breaker is inoperative, refer to figure 2-67, test 3, for procedure.


FLUORESCENT CEILING LIGHTS (8)
NOTE: TWO INCANDESCENT LAMPS ARE LOCATED IN EACH FIXTURE.
CIRCUIT BREAKER BOX
NOTE: CEILING LIGHT SWITCHES ARE INCLUDED IN FIXTURE.

OBSERVED SYMPTOM	PROBABLE CAUSE	REMEDY
DELAYED OR SLOW START	LOW CIRCUIT VOLTAGE OR INCORRECT FREQUENCY	ADJUST VOLTAGE TO 115 VOLTS, 60 CYCLES
	LOW SURROUNDING TEMPERATURE	RAISE ABOVE 65°F.
	END OF LAMP LIFE	REPLACE LAMP
BLINKS, BUT WON'T START	LOOSE SOCKET CONTACTS	REPAIR SOCKET
	LOW CIRCUIT VOLTAGE	ADJUST TO 116 VOLTS
	LOW TEMPERATURE	RAISE TO 65°F.
	END OF LAMP LIFE	REPLACE LAMP
GLOWS DIMLY, BUT DOES NOT BLINK OR START	DEFECTIVE STARTER	REPLACE FIXTURE
	DEFECTIVE BALLAST	REPLACE FIXTURE
STARTS, BUT IS DIM AND HAS DARK AREAS	TTEMPERATURE BELOW 50°F.	RAISE ABOVE 65°F.
	TEMPORARY LAMP DEFECT	ALLOW WARM-UP TIME
BOTH ENDS BLACKENED AND LAMP FLICKERS	END OF LAMP LIFE	REPLACE LAMP

TEST 1. FLUORESCENT LIGHT OBSERVATION TEST


650
GRD
CEILING LIGHT
VAN WIRING HARNESS
GRD
650
FROM LIGHT SWITCH OR OTHER LIGHTS
AC
250V

TEST 2. CEILING LIGHT VOLTAGE TEST

AT 12588

Figure 2–65. Van body 120-volt lighting circuit tests.

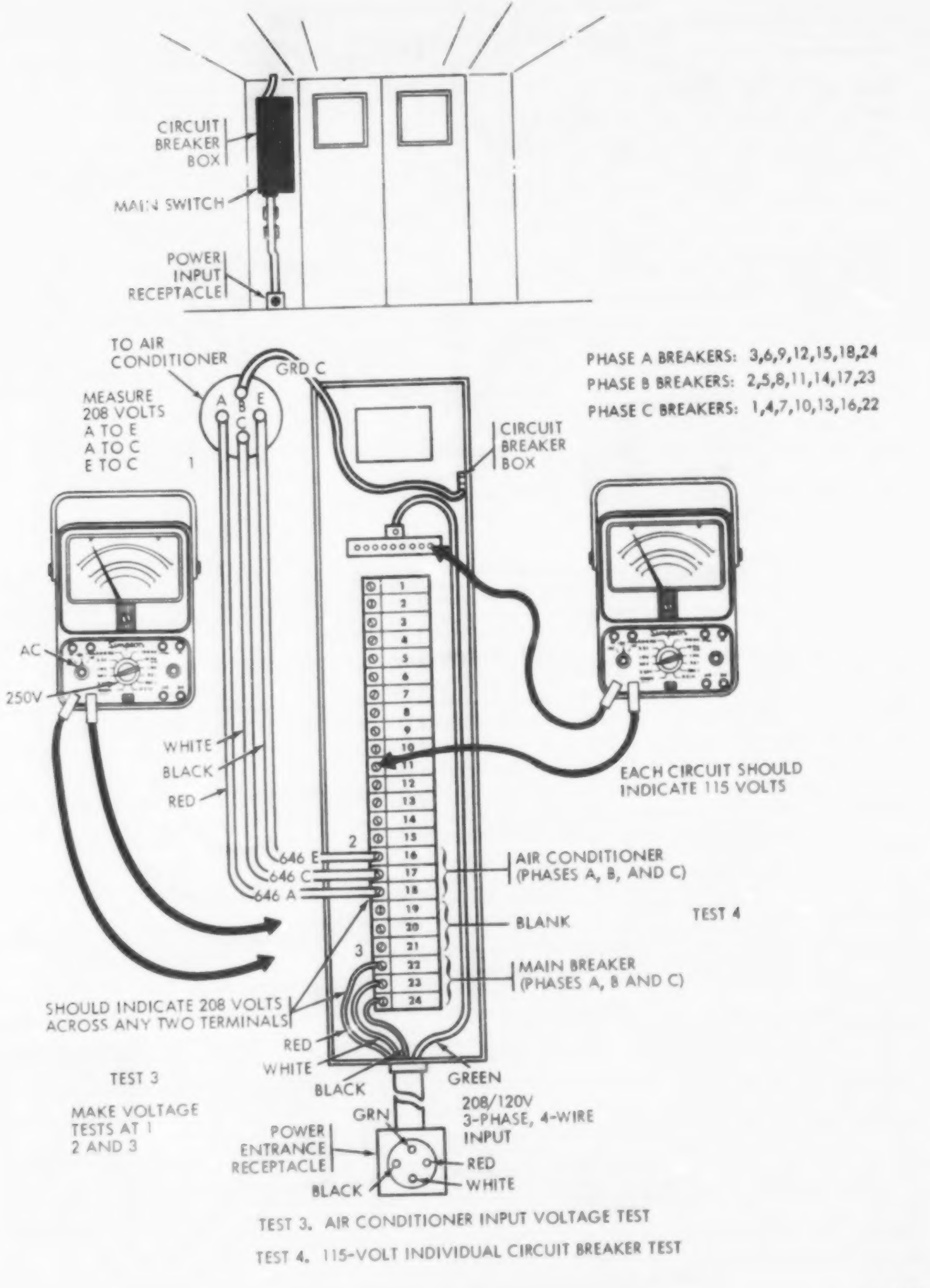

CIRCUIT BREAKER BOX
MAIN SWITCH
POWER INPUT RECEPTACLE
TO AIR CONDITIONER
GRD C
A
B
C
E
MEASURE 208 VOLTS A TO E A TO C E TO C
1
PHASE A BREAKERS: 3,6,9,12,15,18,24
PHASE B BREAKERS: 2,5,8,11,14,17,23
PHASE C BREAKERS: 1,4,7,10,13,16,22
CIRCUIT BREAKER BOX
AC
250V
WHITE
BLACK
RED
EACH CIRCUIT SHOULD INDICATE 115 VOLTS
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2
646 E
646 C
646 A
AIR CONDITIONER (PHASES A, B, AND C)
BLANK
TEST 4
3
MAIN BREAKER (PHASES A, B AND C)
SHOULD INDICATE 208 VOLTS ACROSS ANY TWO TERMINALS
RED
WHITE
BLACK
GREEN
TEST 3
MAKE VOLTAGE TESTS AT 1 2 AND 3
GRN
208/120V 3-PHASE, 4-WIRE INPUT
POWER ENTRANCE RECEPTACLE
RED
WHITE
BLACK
TEST 3. AIR CONDITIONER INPUT VOLTAGE TEST
TEST 4. 115-VOLT INDIVIDUAL CIRCUIT BREAKER TEST
AT 12589

Figure 2-66. Van body 120/208 volt system tests, 1 and 2.

Table 2-5. Troubleshooting the Electrical System—Continued

VAN BODY 120/208-VOLT SYSTEM CIRCUITS—Continued (Figure 2-67)

Malfunction	Circuit	Test
No power available when circuit breakers are turned on.	Incoming power wires	Test 3. Perform 120-volt circuit braker voltag test. Open circuit breaker box to expose circuit breakers. Connect voltmeter as shown in figure 2-67, test 3. With circuit breaker in "ON" position check for 120-volt indication on exposed terminal. If no or low voltage, test incoming power terminals. If 120 volts is indicated, disconnect external power source. Remove individual circuit breaker and inspect for loose, corroded or dirty rear terminal. If terminal is satisfactory, circuit breaker is faculty. If 120 volts is not indicated at incoming power terminals, check van harness, incoming power receptacle and cable, and the power source.

VAN BODY BLACKOUT RELAY SYSTEM CIRCUIT (Figure 2-68)

Malfunction	Circuit	Test

DESCRIPTION: The van body blackout relay system is designed to prevent white light from showing when a door is opened in the van. Door switches are provided to actuate the blackout relay when any door is opened. The blackout relay automatically disconnects the ceiling fluorescent lights and connects the blackout light whenever a door is opened under blackout conditions.

In addition, all 10 receptacles are controlled by the blackout relay system. If any installed equipment will show light outside the van, its receptacle can be switches to the blackout relay circuit so it will also be turned off when any door is opened.

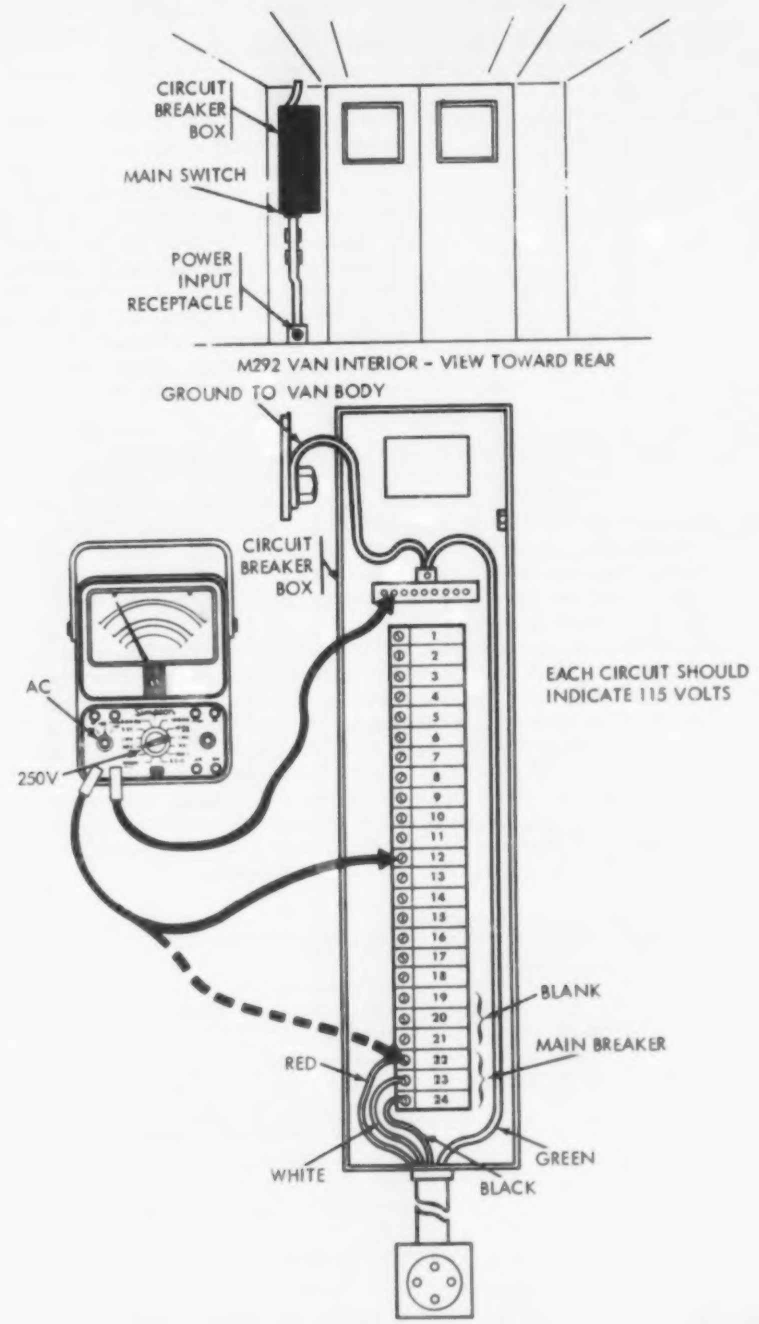
The circuit is energized by switching the "BLACK-OUT CIRCUIT" switch to "ON" position. The door switch series circuit energizes the blackout relay coil from circuit breaker No. 2 via circuits 651, 651A, 651B, 651C to neutral ground. The relay in this position allows current to flow to all active ceiling light and receptacle circuits. When a door is opened, the relay coil is de-energized and the active circuits are disconnected. Simultaneously, circuits 655B, 655C and 647 are energized by the N.C. contact to light the blackout light. Refer to figure 2-68.

VAN BODY BLACKOUT RELAY SYSTEM CIRCUIT (Figure 2-69)

Malfunction	Circuit	Test
Blackout relay system inoperative on some functions.	647, 650, 651, 651A, 651B, 651C, 655A, 655B, 655C, GRD B	Test 1. Perform blackout relay voltage tests. Put blackout switch in "blackout" position. Push circuit breaker No. 2 to "ON" position. Listen for the "click" of the blackout relay when any door is opened. If no sound is heard, check for proper closure of roof and side panels, check door switch operation, and/or inspect van body harness. Figure 2-69, test 1, contains a troubleshooting table. Note all malfunctions of the system, and consult the table in conjunction with the wiring diagram (fig 2-68). In obstinate cases, contact direct support maintenance for assistance.

2-27. Wiring Diagrams

Wiring diagrams of the major wiring harnesses in the M656, XM757 and XM791 trucks are shown in figures 2-70 through 2-82. Since many circuits numbers are interconnected inside the wiring harness, these diagrams will prove useful in tracing a defective circuit. Minor cables, such as battery cables and starter cables have not been included, since they are self-evident.


CIRCUIT BREAKER BOX
MAIN SWITCH
POWER INPUT RECEPTACLE
M292 VAN INTERIOR - VIEW TOWARD REAR
GROUND TO VAN BODY
CIRCUIT BREAKER BOX
AC
250V
EACH CIRCUIT SHOULD INDICATE 115 VOLTS
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
BLANK
MAIN BREAKER
RED
WHITE
BLACK
GREEN

AT 12590

Figure 2-67. Van body 120/208 volt system test 3.

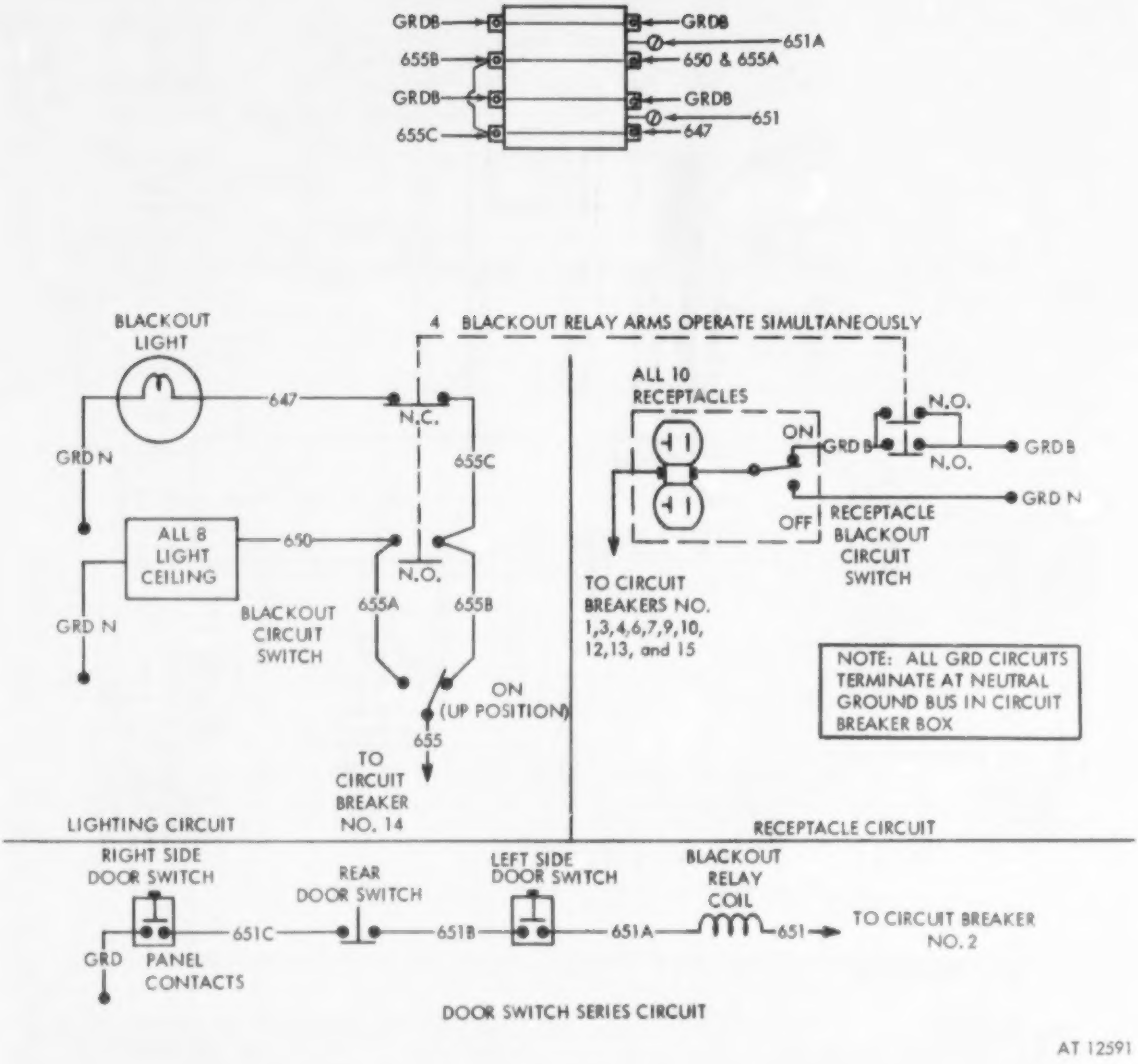
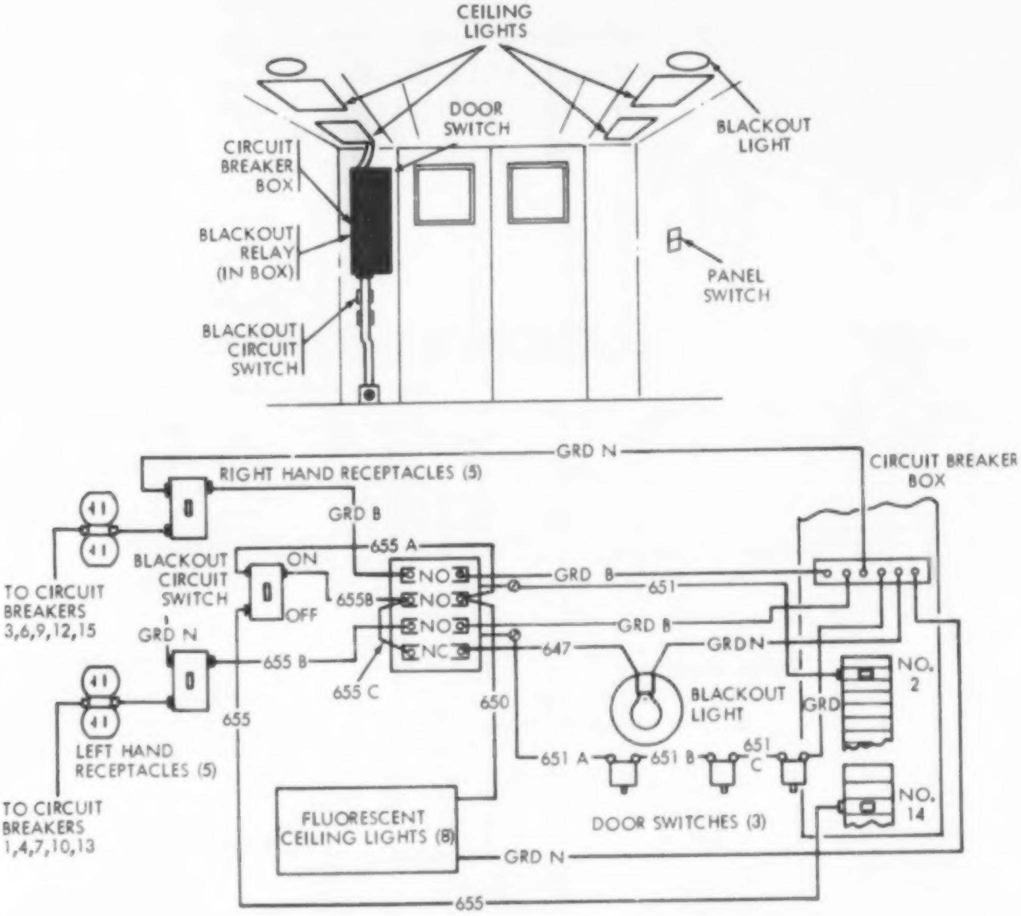

GRDB
655B
GRDB
655C
GRDB
651A
650 & 655A
GRDB
651
647
BLACKOUT LIGHT
4 BLACKOUT RELAY ARMS OPERATE SIMULTANEOUSLY
647
N.C.
GRD N
655C
ALL 8 LIGHT CEILING
650
N.O.
GRD N
BLACKOUT CIRCUIT SWITCH
655A
655B
ON (UP POSITION)
655
TO CIRCUIT BREAKER NO. 14
LIGHTING CIRCUIT
ALL 10 RECEPTACLES
ON
OFF
GRD B
N.O.
N.O.
GRDB
GRD N
RECEPTACLE BLACKOUT CIRCUIT SWITCH
TO CIRCUIT BREAKERS NO. 1,3,4,6,7,9,10, 12,13, and 15
NOTE: ALL GRD CIRCUITS TERMINATE AT NEUTRAL GROUND BUS IN CIRCUIT BREAKER BOX
RECEPTACLE CIRCUIT
RIGHT SIDE DOOR SWITCH
REAR DOOR SWITCH
LEFT SIDE DOOR SWITCH
BLACKOUT RELAY COIL
651C
651B
651A
651
TO CIRCUIT BREAKER NO. 2
GRD
PANEL CONTACTS
DOOR SWITCH SERIES CIRCUIT
AT 12591

Figure 2-68. Van body (XM791) blackout relay system wiring diagram.

Electrical circuit numbers for wiring diagrams figures 2-80, 2-81, and 2-82.

Circuit No.	Description
3	Alternator ground to engine
5	Alternator output (joins to circuit 6)
6	Battery to starting motor circuit
7	Battery to vehicle ground circuit (battery negative return circuit)
10	Battery feed to master switch, light switch, horn and fuel cut-off solenoid.
11	Master switch feed.
14A	Master switch to neutral safety switch to starter relay coil
14B	Starter relay contacts to starter solenoid


CEILING LIGHTS
DOOR SWITCH
BLACKOUT LIGHT
CIRCUIT BREAKER BOX
BLACKOUT RELAY (IN BOX)
PANEL SWITCH
BLACKOUT CIRCUIT SWITCH
GRD N
CIRCUIT BREAKER BOX
RIGHT HAND RECEPTACLES (5)
GRD B
655 A
ON
NO
NO
NO
NC
GRD B
651
655B
OFF
BLACKOUT CIRCUIT SWITCH
TO CIRCUIT BREAKERS 3,6,9,12,15
GRD N
655 B
GRD B
647
GRD N
NO. 2
655 C
650
BLACKOUT LIGHT
GRD
655
LEFT HAND RECEPTACLES (5)
651 A
651 B
651 C
NO. 14
TO CIRCUIT BREAKERS 1,4,7,10,13
FLUORESCENT CEILING LIGHTS (8)
DOOR SWITCHES (3)
GRD N
655

TEST NO.	TEST CONDITIONS			LIGHTING		115.V SHOULD BE BETWEEN	MEASURED AT	FAULTY PART IF NO VOLTAGE
	CIRCUIT BREAKER NO. 2	B.O. SWITCH	DOOR POSITION	B.O. LIGHT	CEILING LIGHT			
A	ON	ON	OPEN	OUT	OUT	655 & GRD	CIRCUIT BREAKER NO. 14	CIRCUIT BREAKER NO. 14
B	ON	ON	OPEN	OUT	OUT	655B & GRD	RELAY	B.O. SWITCH
C	ON	ON	OPEN	OUT	OUT	647 & GRD	RELAY	RELAY
D	ON	ON	CLOSED	LIT	OUT	651 & GRD	RELAY	DOOR SWITCH
E	ON	ON	CLOSED	LIT	OUT	651A & GRD	RELAY	RELAY
F	OFF	ON	CLOSED	LIT	LIT	–	–	RELAY
G	OFF	ON	OPEN	OUT	LIT	–	–	RELAY
H	OFF	ON	CLOSED	OUT	OUT	647 & GRD	RELAY	RELAY
I	ANY	OFF	ANY	OUT	OUT	655 & GRD	CIRCUIT BREAKER NO. 14	CIRCUIT BREAKER NO. 14
J	ANY	OFF	ANY	OUT	OUT	655A & GRD	B.O. SWITCH	B.O. SWITCH
K	ANY	OFF	ANY	OUT	OUT	650 & GRD	CEILING LIGHT	VAN HARNESS

AT 12592

Figure 2–69. Van body (XM791) blackout relay system tests.

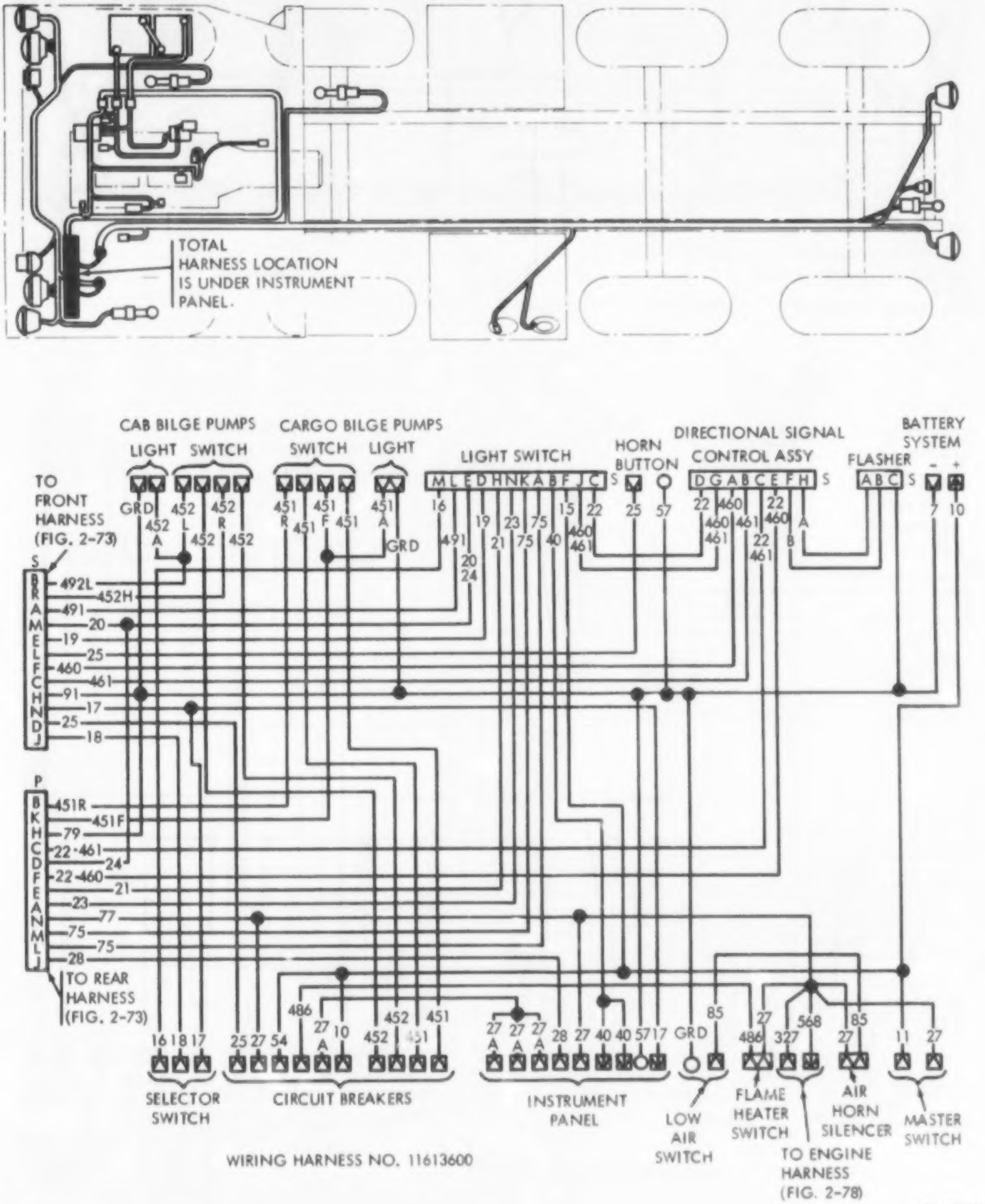

TOTAL HARNESS LOCATION IS UNDER INSTRUMENT PANEL.
CAB BILGE PUMPS
LIGHT
SWITCH
CARGO BILGE PUMPS
SWITCH
LIGHT
LIGHT SWITCH
HORN BUTTON
DIRECTIONAL SIGNAL CONTROL ASSY
FLASHER
BATTERY SYSTEM
TO FRONT HARNESS (FIG. 2-73)
TO REAR HARNESS (FIG. 2-73)
SELECTOR SWITCH
CIRCUIT BREAKERS
INSTRUMENT PANEL
LOW AIR SWITCH
FLAME HEATER SWITCH
TO ENGINE HARNESS (FIG. 2-78)
AIR HORN SILENCER
MASTER SWITCH
WIRING HARNESS NO. 11613600
AT 12593

Figure 2-70. Wiring diagram, cab lighting, controls and instruments wiring harness, M656 truck.

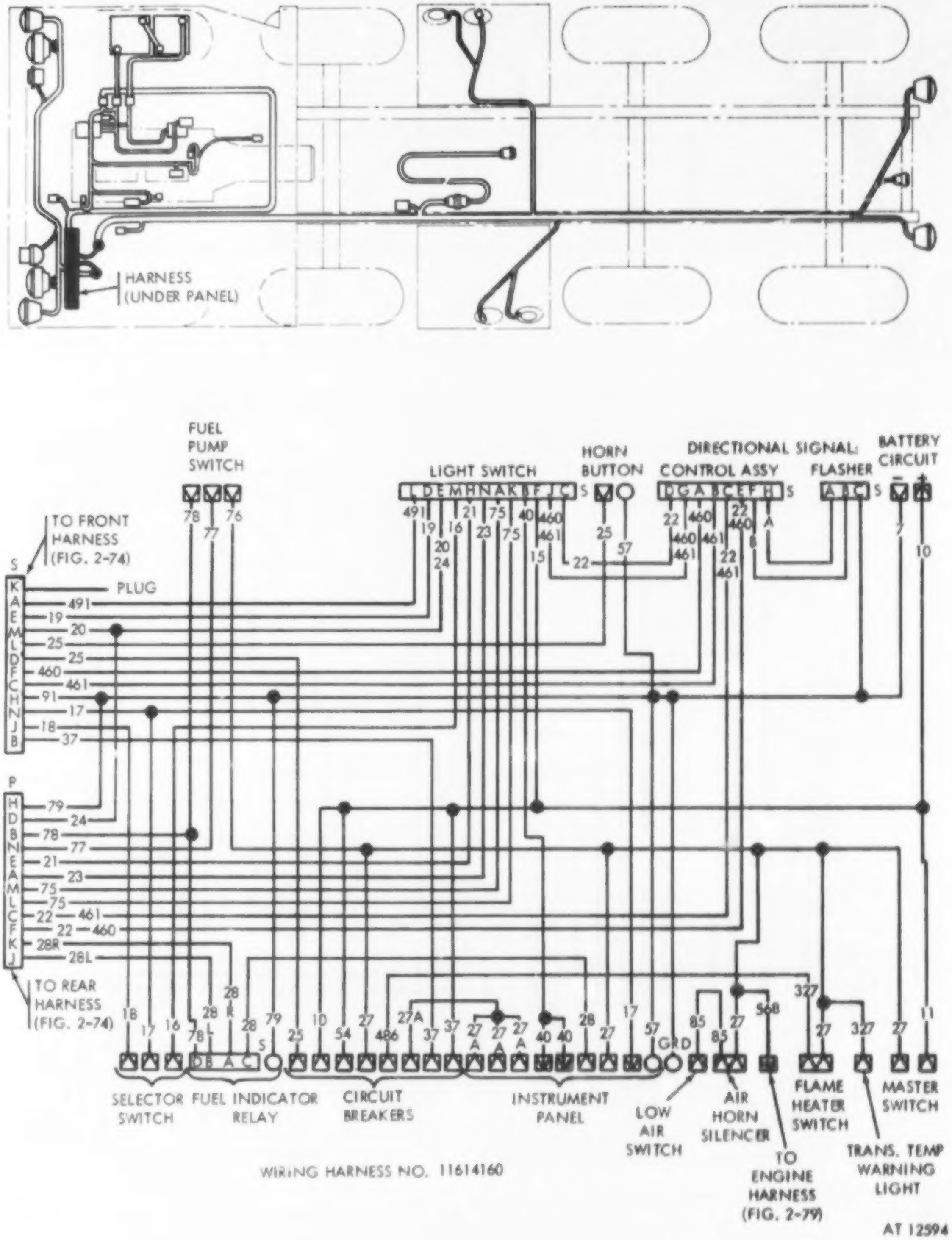
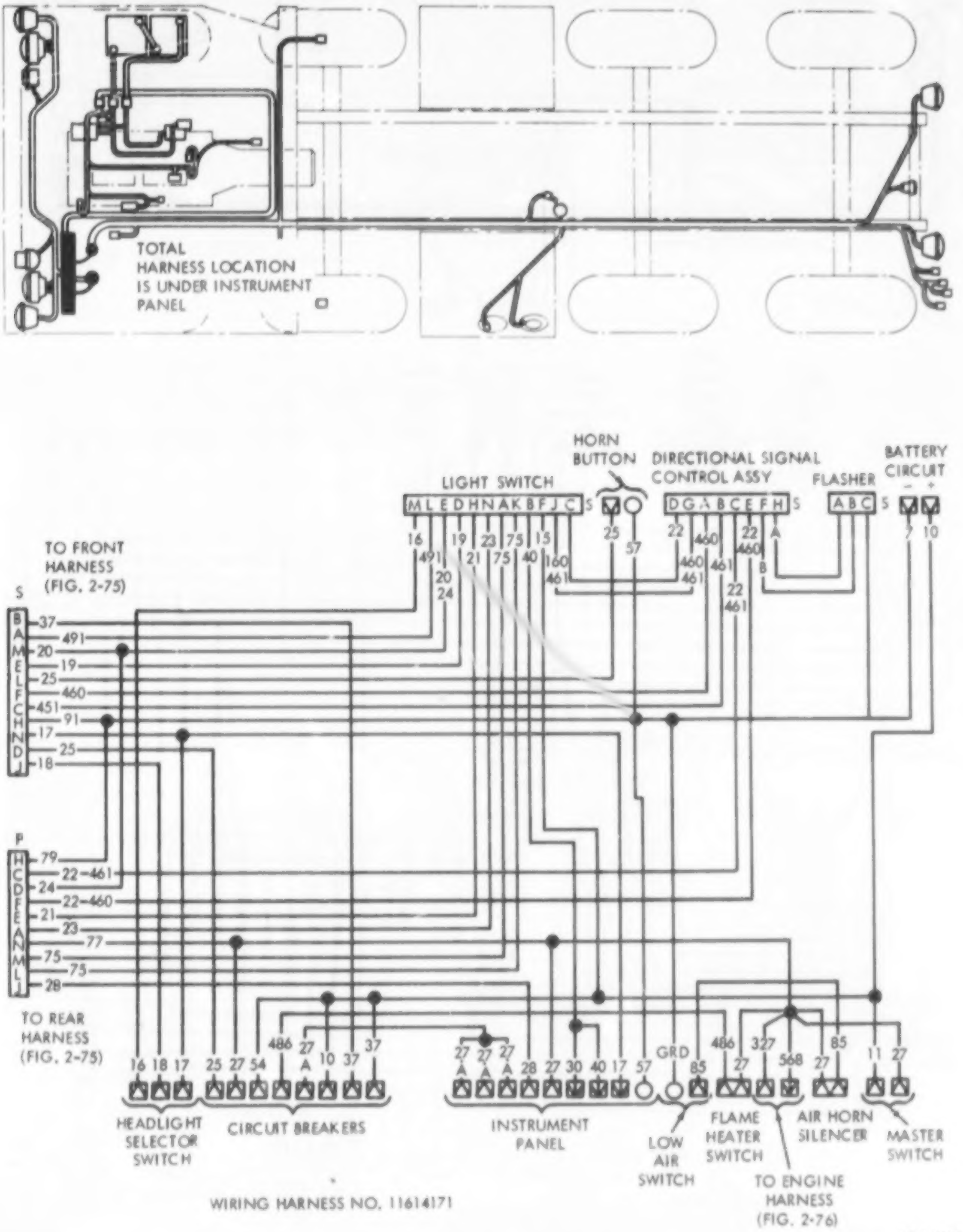

HARNESS
(UNDER PANEL)
FUEL PUMP SWITCH
LIGHT SWITCH
HORN BUTTON
DIRECTIONAL SIGNAL: CONTROL ASSY
FLASHER
BATTERY CIRCUIT
L D E M H N A K B F J C
D G A B C E F H
A B C
TO FRONT HARNESS (FIG. 2-74)
PLUG
S
K A E M L D F C H N J B
491 19 20 25 25 460 461 91 17 18 37
P
H D B N E A M L C F K J
79 24 78 77 21 23 75 75 22 461 22 460 28R 28L
TO REAR HARNESS (FIG. 2-74)
78 77 76
491 19 20 24 16 21 23 75 75 40 460 461 15 22
25 57
22 460 460 461 461 22 461 22 460 A B
7 10
18 17 16 78 28 L 28 R 28 79 25 10 54 27 486 27A 37 37 27 A 27 A 27 A 40 40 28 27 17 57 GRD 85 85 27 568 327 27 327 27 11
D B A C
S
SELECTOR SWITCH
FUEL INDICATOR RELAY
CIRCUIT BREAKERS
INSTRUMENT PANEL
LOW AIR SWITCH
AIR HORN SILENCER
TO ENGINE HARNESS (FIG. 2-79)
FLAME HEATER SWITCH
TRANS. TEMP WARNING LIGHT
MASTER SWITCH
WIRING HARNESS NO. 11614160
AT 12594

Figure 2-71. Wiring diagram, cab lighting, controls and instruments wiring harness, XM757 truck.


TOTAL
HARNESS LOCATION
IS UNDER INSTRUMENT
PANEL
HORN
BUTTON
DIRECTIONAL SIGNAL
CONTROL ASSY
BATTERY
CIRCUIT
– +
LIGHT SWITCH
M L E D H N A K B F J C
S
D G A B C E F H
FLASHER
A B C
16 491 20 24 19 21 23 75 75 40 15 160 461
25 57
22 460 460 461 461 22 460 22 461 A B
7 10
TO FRONT
HARNESS
(FIG. 2-75)
S
B 37
A 491
M 20
E 19
L 25
F 460
C 451
H 91
N 17
D 25
J 18
P
H 79
C 22-461
D 24
F 22-460
E 21
A 23
N 77
M 75
L 75
J 28
TO REAR
HARNESS
(FIG. 2-75)
16 18 17 25 27 54 486 27 A 10 37 37
27 A 27 A 27 A 28 27 30 40 17 57 GRD 85 486 27 327 568 27 85 11 27
HEADLIGHT
SELECTOR
SWITCH
CIRCUIT BREAKERS
INSTRUMENT
PANEL
LOW
AIR
SWITCH
FLAME
HEATER
SWITCH
TO ENGINE
HARNESS
(FIG. 2-76)
AIR HORN
SILENCER
MASTER
SWITCH
WIRING HARNESS NO. 11614171

AT 12595

Figure 2-72. Wiring diagram, cab lighting, controls and instruments wiring harness, XM791 truck.

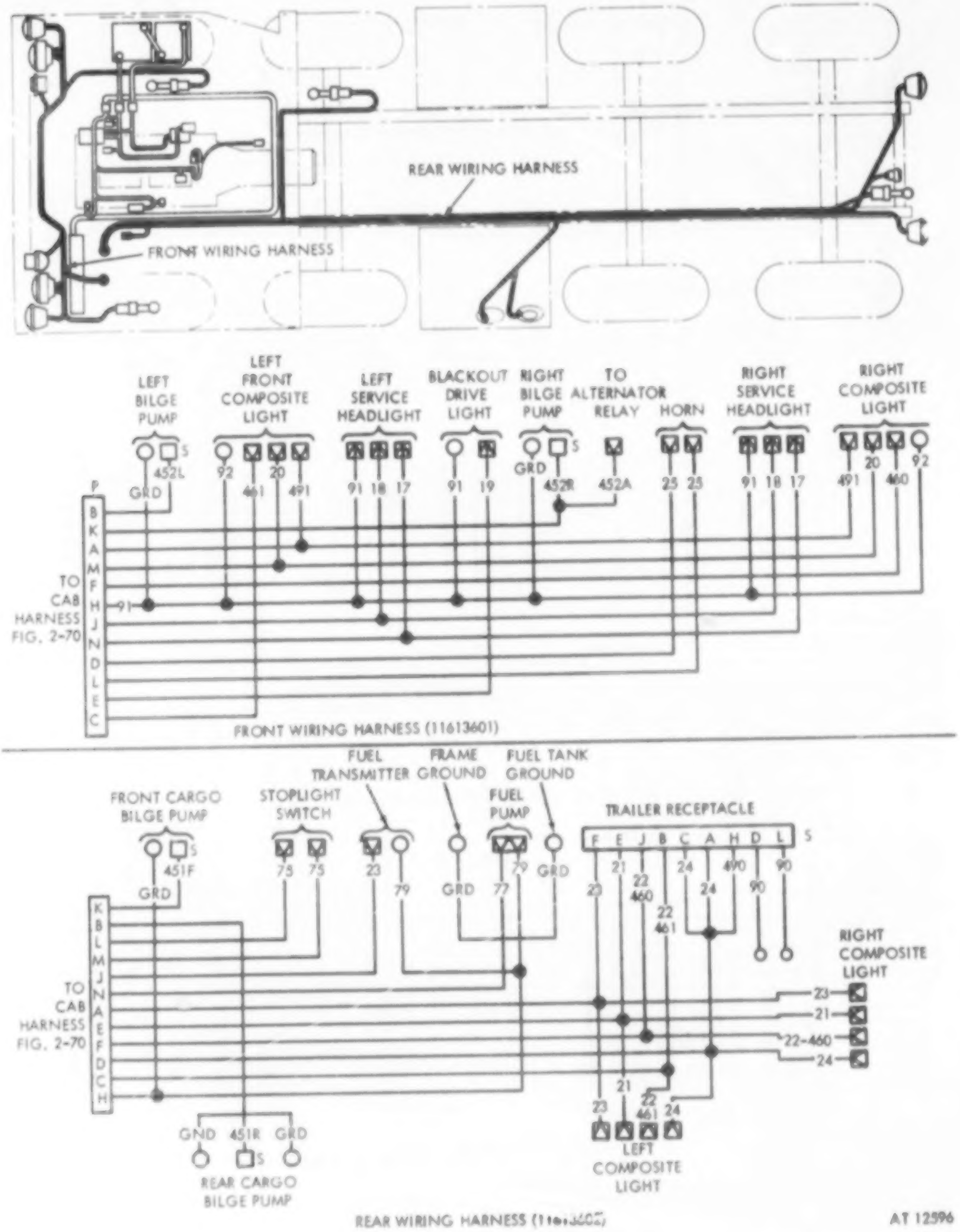
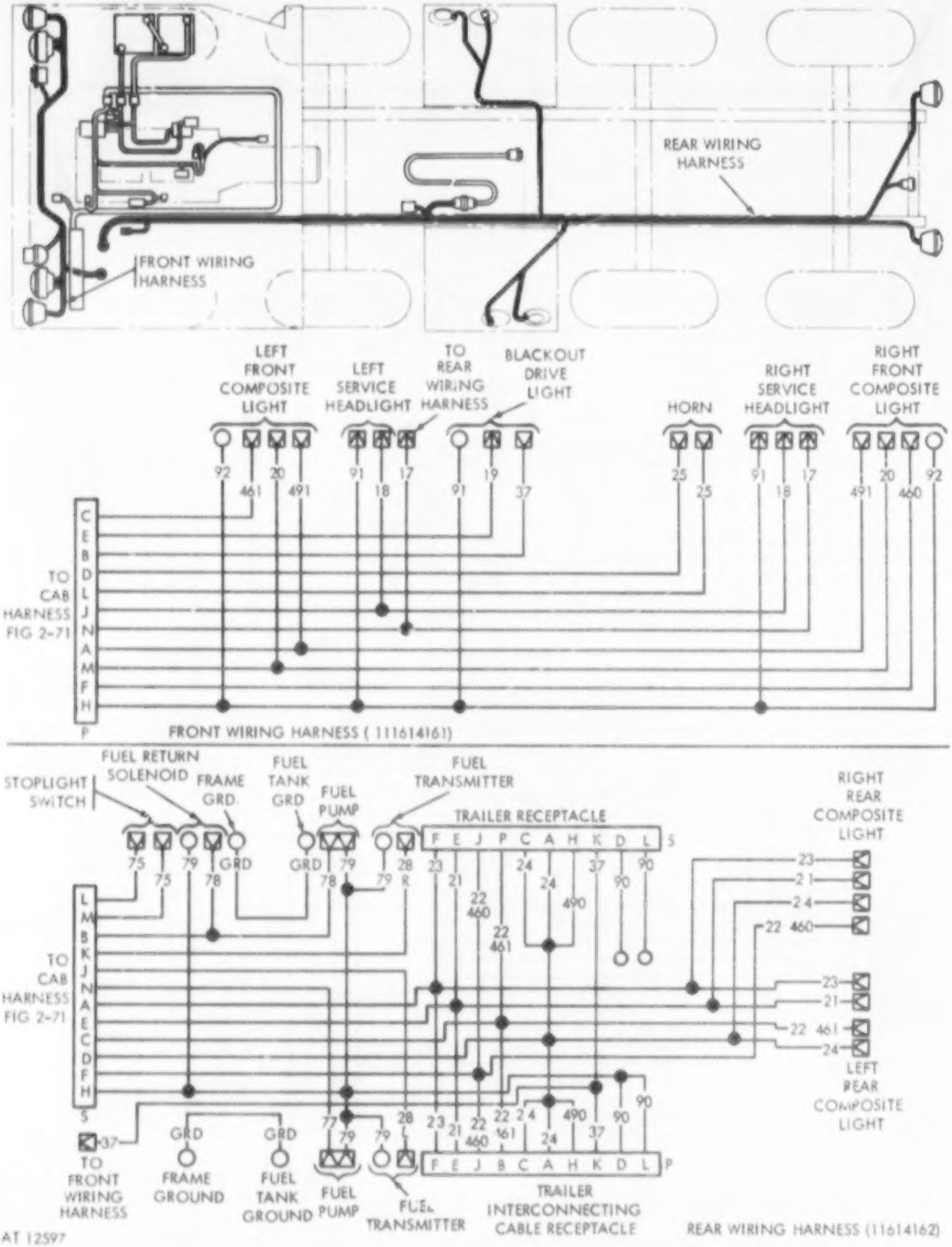

REAR WIRING HARNESS
FRONT WIRING HARNESS
LEFT BILGE PUMP
LEFT FRONT COMPOSITE LIGHT
LEFT SERVICE HEADLIGHT
BLACKOUT DRIVE LIGHT
RIGHT BILGE PUMP
TO ALTERNATOR RELAY
HORN
RIGHT SERVICE HEADLIGHT
RIGHT COMPOSITE LIGHT
S
452L
GRD
92
461
20
491
91
18
17
19
452R
452A
25
460
P
B
K
A
M
F
H
J
N
D
L
E
C
TO CAB HARNESS FIG. 2-70
FRONT WIRING HARNESS (11613601)
FRONT CARGO BILGE PUMP
STOPLIGHT SWITCH
FUEL TRANSMITTER
FRAME GROUND
FUEL TANK GROUND
FUEL PUMP
TRAILER RECEPTACLE
451F
75
23
79
77
21
22
24
490
90
RIGHT COMPOSITE LIGHT
22-460
GND
451R
REAR CARGO BILGE PUMP
LEFT COMPOSITE LIGHT
REAR WIRING HARNESS (11613602)
AT 12596

Figure 2-73. Wiring diagram, front and rear wiring harnesses, M656 truck.


REAR WIRING HARNESS
FRONT WIRING HARNESS
LEFT FRONT COMPOSITE LIGHT
LEFT SERVICE HEADLIGHT
TO REAR WIRING HARNESS
BLACKOUT DRIVE LIGHT
HORN
RIGHT SERVICE HEADLIGHT
RIGHT FRONT COMPOSITE LIGHT
92 461 20 491 91 18 17 91 19 37 25 25 91 18 17 491 20 460 92
TO CAB HARNESS FIG 2-71
C E B D L J N A M F H
P
FRONT WIRING HARNESS (11614161)
STOPLIGHT SWITCH
FUEL RETURN SOLENOID
FRAME GRD.
FUEL TANK GRD
FUEL PUMP
FUEL TRANSMITTER
TRAILER RECEPTACLE
F E J P C A H K D L
S
RIGHT REAR COMPOSITE LIGHT
75 75 79 78 GRD GRD 79 78 79 28 R 23 21 22 460 22 461 24 24 490 37 90 90
TO CAB HARNESS FIG 2-71
L M B K J N A E C D F H
S
23 21 24 22 460
23 21 22 461 24
LEFT REAR COMPOSITE LIGHT
37
TO FRONT WIRING HARNESS
GRD
FRAME GROUND
GRD
FUEL TANK GROUND
77 79
FUEL PUMP
79 28 L
FUEL TRANSMITTER
23 21 22 460 22 461 24 490 24 37 90 90
F E J B C A H K D L
P
TRAILER INTERCONNECTING CABLE RECEPTACLE
REAR WIRING HARNESS (11614162)

AT 12597

Figure 2-74. Wiring diagram, front and rear wiring harnesses, XM757 truck.

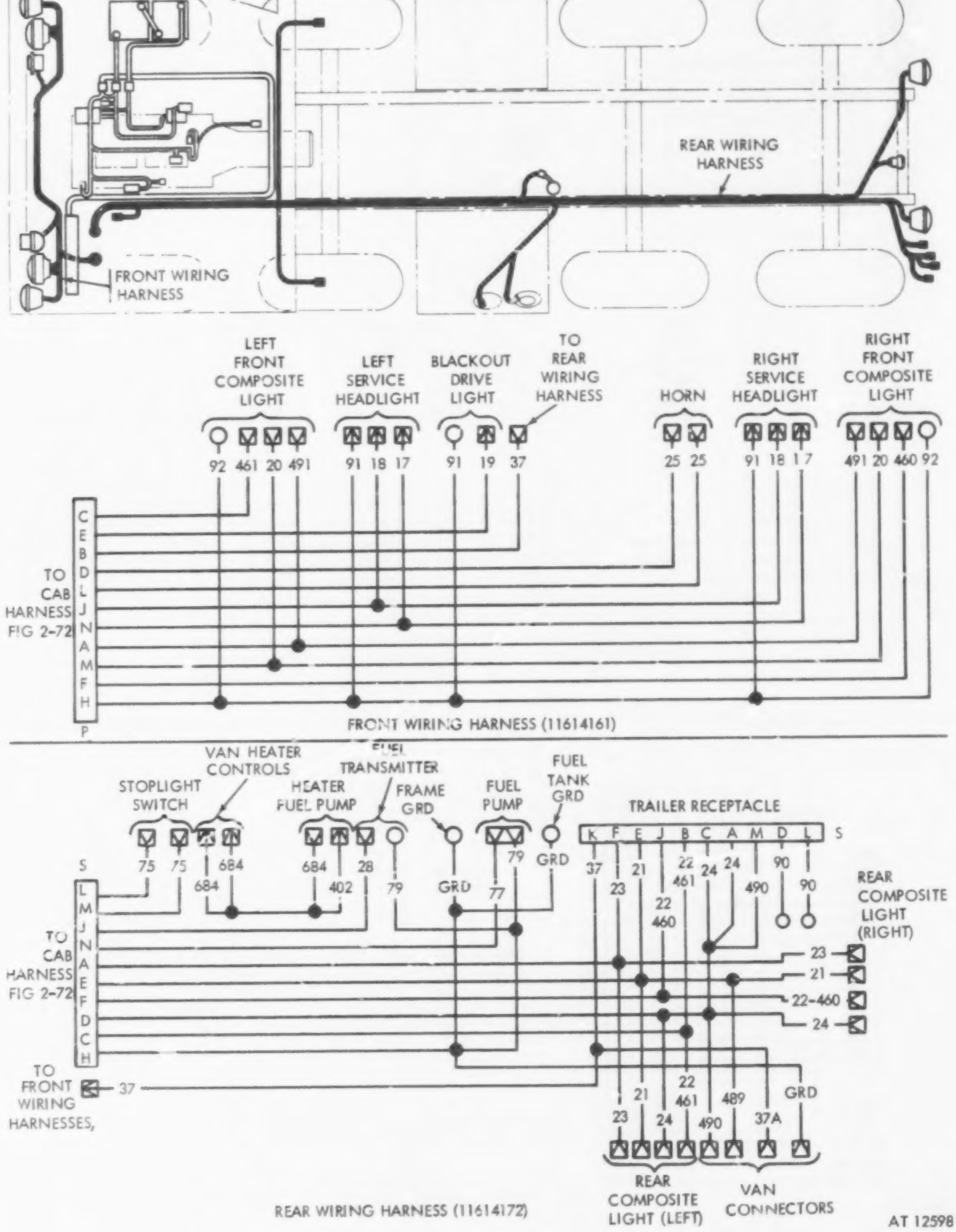
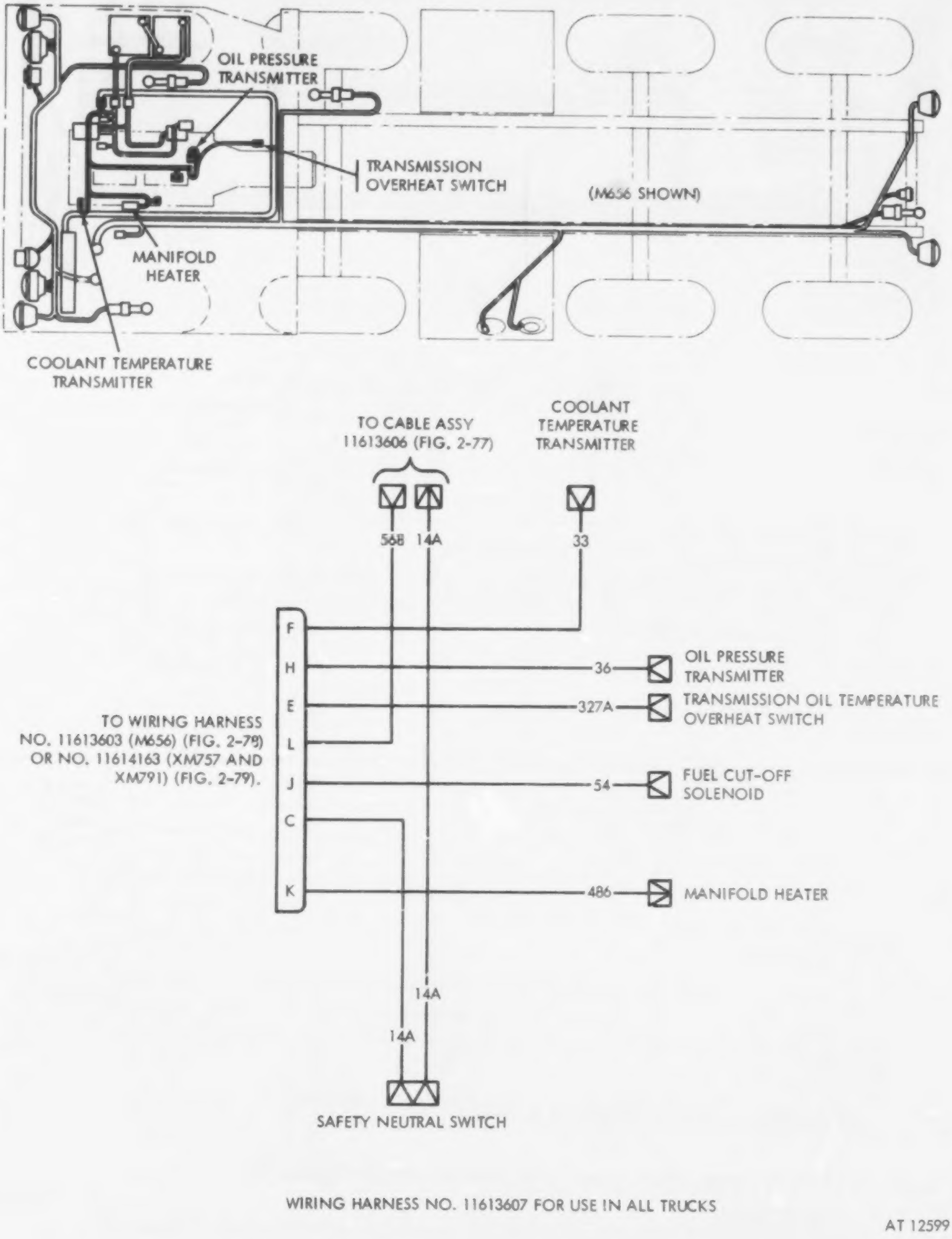

REAR WIRING HARNESS
FRONT WIRING HARNESS
LEFT FRONT COMPOSITE LIGHT
LEFT SERVICE HEADLIGHT
BLACKOUT DRIVE LIGHT
TO REAR WIRING HARNESS
HORN
RIGHT SERVICE HEADLIGHT
RIGHT FRONT COMPOSITE LIGHT
92 461 20 491
91 18 17
91 19 37
25 25
91 18 17
491 20 460 92
C E B D L J N A M F H P
TO CAB HARNESS FIG 2-72
FRONT WIRING HARNESS (11614161)
STOPLIGHT SWITCH
VAN HEATER CONTROLS
HEATER FUEL PUMP
FUEL TRANSMITTER
FRAME GRD
FUEL PUMP
FUEL TANK GRD
TRAILER RECEPTACLE
K F E J B C A M D L
S
75 75 684 684
684 402 28 79
GRD 77 79 GRD
37 23 21 22 461 22 460 24 24 490 90 90
L M J N A E F D C H
TO CAB HARNESS FIG 2-72
REAR COMPOSITE LIGHT (RIGHT)
23
21
22-460
24
TO FRONT WIRING HARNESSES,
37
21 22 461 489 GRD
23 24 490 37A
REAR COMPOSITE LIGHT (LEFT)
VAN CONNECTORS
REAR WIRING HARNESS (11614172)
AT 12598

Figure 2-75. Wiring diagram, front and rear wiring harnesses, XM791 truck.


OIL PRESSURE TRANSMITTER
TRANSMISSION OVERHEAT SWITCH
(M656 SHOWN)
MANIFOLD HEATER
COOLANT TEMPERATURE TRANSMITTER
TO CABLE ASSY 11613606 (FIG. 2-77)
COOLANT TEMPERATURE TRANSMITTER
56B
14A
33
F
H
E
L
J
C
K
TO WIRING HARNESS NO. 11613603 (M656) (FIG. 2-79) OR NO. 11614163 (XM757 AND XM791) (FIG. 2-79).
36
OIL PRESSURE TRANSMITTER
327A
TRANSMISSION OIL TEMPERATURE OVERHEAT SWITCH
54
FUEL CUT-OFF SOLENOID
486
MANIFOLD HEATER
14A
14A
SAFETY NEUTRAL SWITCH

WIRING HARNESS NO. 11613607 FOR USE IN ALL TRUCKS

AT 12599

Figure 2-76. Wiring diagram, engine compartment to engine components wiring harness.

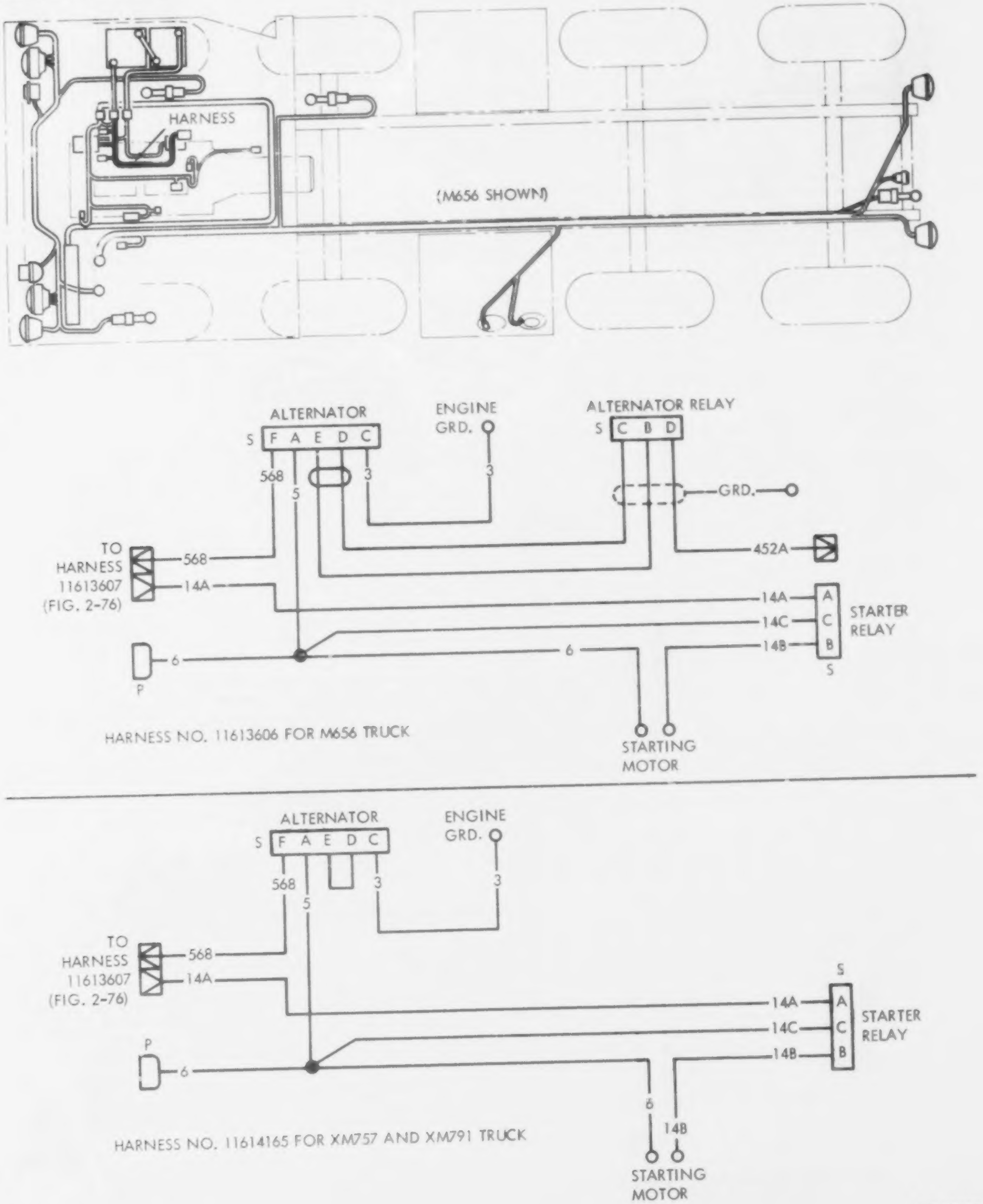

HARNESS
(M656 SHOWN)
ALTERNATOR
S F A E D C
568
5
3
ENGINE
GRD.
3
ALTERNATOR RELAY
S C B D
GRD.
452A
TO
HARNESS
11613607
(FIG. 2-76)
568
14A
14A
14C
14B
A
C
B
S
STARTER
RELAY
6
P
6
HARNESS NO. 11613606 FOR M656 TRUCK
STARTING
MOTOR
ALTERNATOR
S F A E D C
ENGINE
GRD.
568
5
3
3
TO
HARNESS
11613607
(FIG. 2-76)
568
14A
S
14A
14C
14B
A
C
B
STARTER
RELAY
P
6
6
14B
HARNESS NO. 11614165 FOR XM757 AND XM791 TRUCK
STARTING
MOTOR
AT 12600

Figure 2-77. Wiring diagram, alternator and starting motor wiring harness.

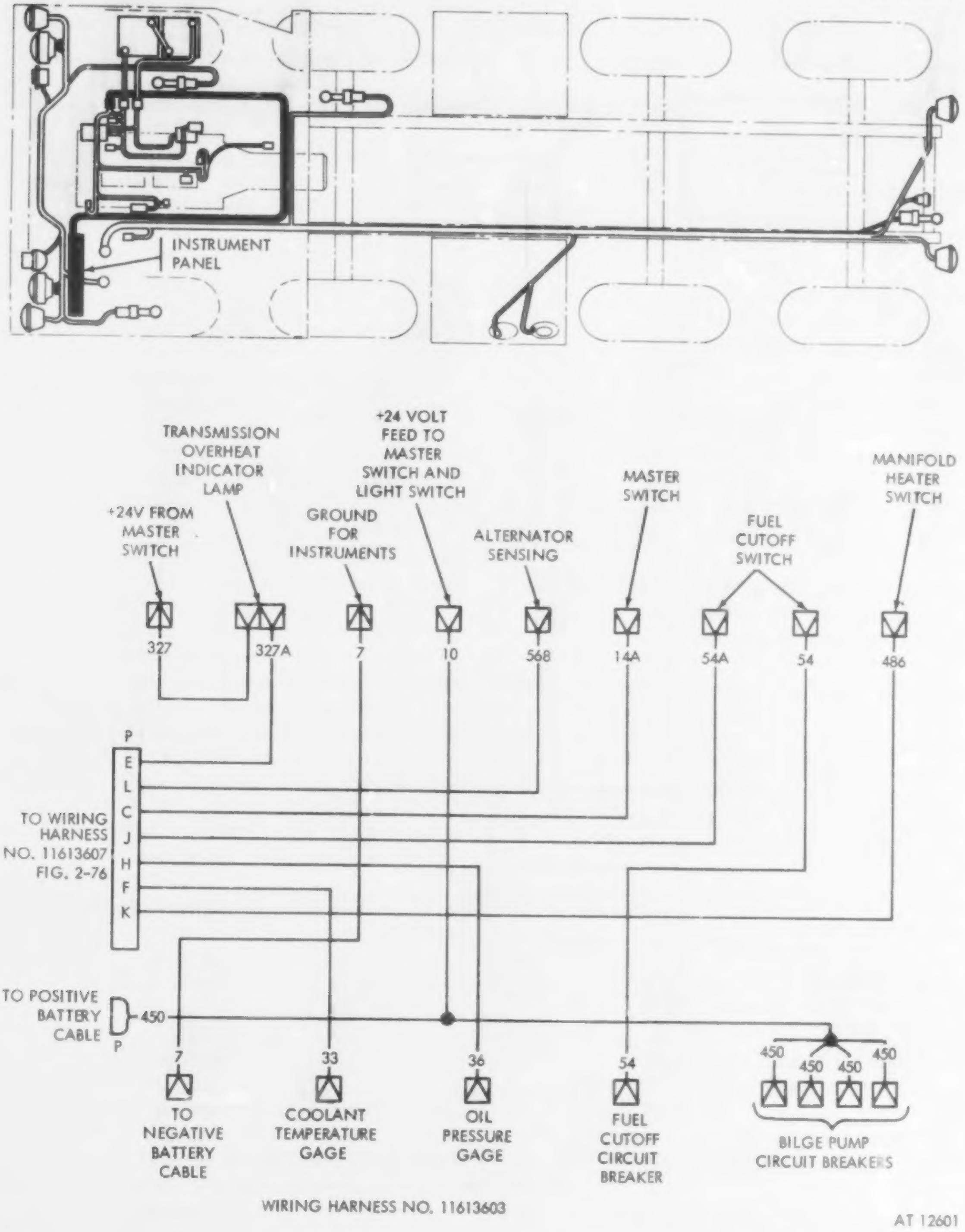

INSTRUMENT PANEL
+24V FROM MASTER SWITCH
TRANSMISSION OVERHEAT INDICATOR LAMP
GROUND FOR INSTRUMENTS
+24 VOLT FEED TO MASTER SWITCH AND LIGHT SWITCH
ALTERNATOR SENSING
MASTER SWITCH
FUEL CUTOFF SWITCH
MANIFOLD HEATER SWITCH
327
327A
7
10
568
14A
54A
54
486
P
E
L
C
J
H
F
K
TO WIRING HARNESS NO. 11613607 FIG. 2-76
TO POSITIVE BATTERY CABLE
450
P
7
33
36
54
450
450
450
450
TO NEGATIVE BATTERY CABLE
COOLANT TEMPERATURE GAGE
OIL PRESSURE GAGE
FUEL CUTOFF CIRCUIT BREAKER
BILGE PUMP CIRCUIT BREAKERS
WIRING HARNESS NO. 11613603
AT 12601

Figure 2-78. Wiring diagram, engine transmitters to instrument panel wiring harness, M656 truck.

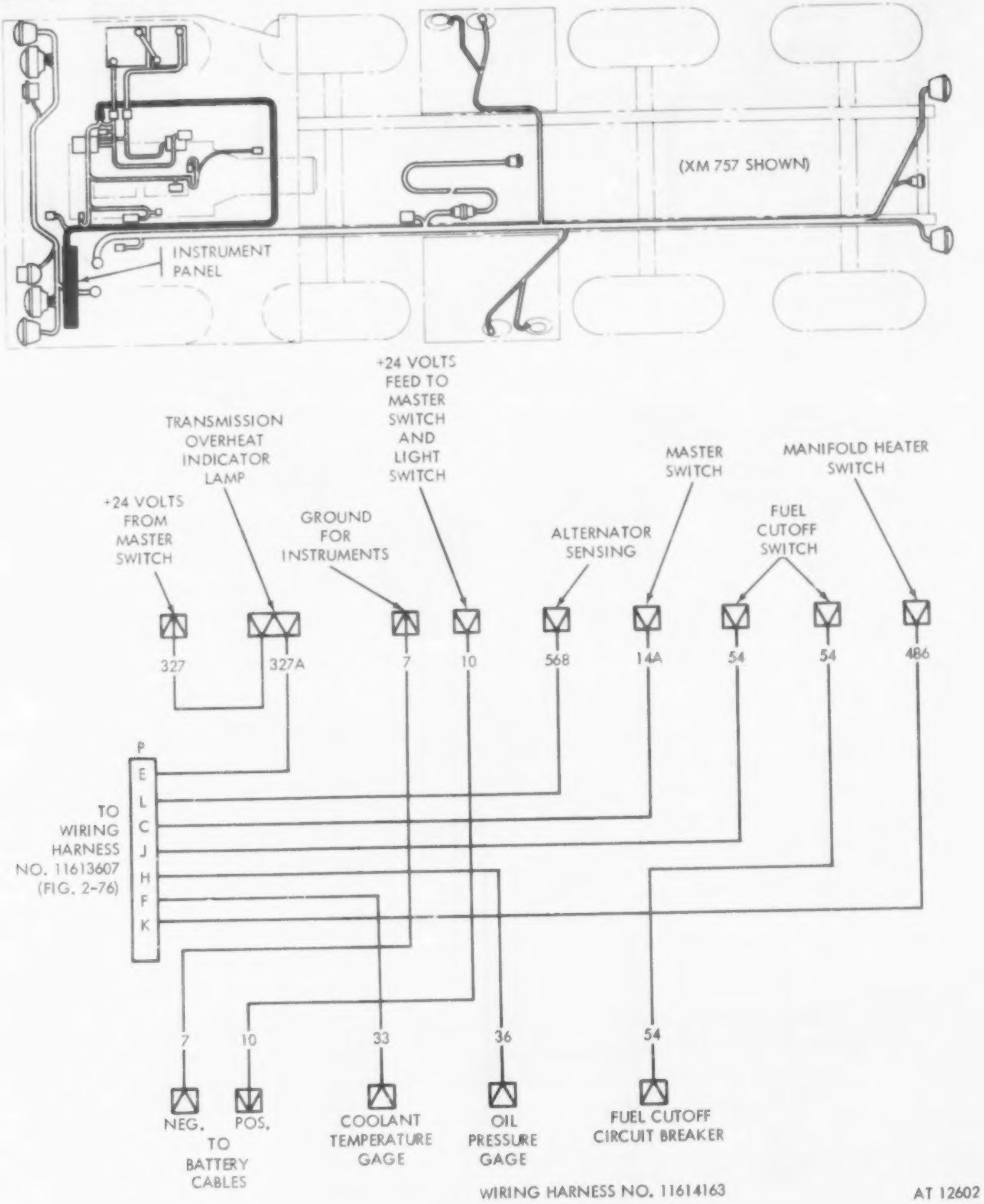

(XM 757 SHOWN)
INSTRUMENT PANEL
+24 VOLTS FROM MASTER SWITCH
TRANSMISSION OVERHEAT INDICATOR LAMP
GROUND FOR INSTRUMENTS
+24 VOLTS FEED TO MASTER SWITCH AND LIGHT SWITCH
ALTERNATOR SENSING
MASTER SWITCH
FUEL CUTOFF SWITCH
MANIFOLD HEATER SWITCH
327
327A
7
10
568
14A
54
54
486
P
E
L
C
J
H
F
K
TO WIRING HARNESS NO. 11613607 (FIG. 2-76)
7
10
33
36
54
NEG.
POS.
TO BATTERY CABLES
COOLANT TEMPERATURE GAGE
OIL PRESSURE GAGE
FUEL CUTOFF CIRCUIT BREAKER
WIRING HARNESS NO. 11614163
AT 12602

Figure 2-79. Wiring diagram, engine transmitters to instrument panel wiring harness, XM757 and XM791 trucks.

Circuit No.	Description
14C	Starter relay contacts to battery (joins to circuit 6)
15	Light switch main feed (from circuit 10)
16	Light switch to dimmer switch
17	Dimmer switch to service headlamp—high beam
18	Dimmer switch to service headlamp—low beam
19	Light switch to blackout driving lamp
20	Light switch to blackout marker lamp
21	Light switch to service taillamp
22	Light switch to directional signal control unit
22–460	Direction signal control unit to right rear service stoplight
22–461	Direction signal control unit to left rear service stoplight
23	Light switch to blackout stoplight
24	Light switch to blackout taillamp and trailer receptacle
25	Horn, horn switch, horn circuit breaker
27	Instrument panel feed (without circuit breaker)
27A	Instrument panel feed from circuit breaker
28	Fuel quantity gage to fuel sending unit (M656, XM791 trucks)
28	Fuel quantity gage to fuel gage switching relay common (XM-757 truck)
28R	Fuel switching relay to fuel quantity sending unit, right side tank (XM757 truck)
28L	Fuel switching relay to fuel quantity sending unit, left side tank (XM757 truck)
33	Coolant temperature gage to sending unit
36	Oil pressure gage to sending unit
37	Auxiliary circuit breaker to van body or trailer connecting cable
40	Light switch to instrument panel lamps
54	Fuel cut-off switch, solenoid and circuit breaker (from circuit 10)
57	Negative ground return for instrument cluster panel and horn switch
68	Battery interconnecting cable
75	Stoplight switch circuit
76	Feed to fuel pump transfer switch (XM757 truck)
77	Feed to fuel pump (M656, XM791 trucks)
77	Fuel pump transfer switch to left hand tank fuel pump
78	Fuel pump transfer switch to right hand tank fuel pump fuel quantity gage relay, and fuel return solenoid valve
79	Ground return for fuel system components
85	Low air pressure switch to low air pressure indicator cut-off switch
90, 91, 92	Ground (negative) return circuit for various components (via circuit 7 to negative battery terminal.
327	Transmission overheat indicator feed (from circuit 27)
327A	Transmission overheat indicator to transmission temperature overheat switch
450	Main feed to bilge pump circuit breakers, and feed to circuit 10 (from circuit 6) (M656 truck)
451	Cargo bilge pump circuit breakers to cargo box bilge pump switch (from circuit 450)
451A	Cargo bilge pump switch to cargo bilge pumps indicator light (from 451F) (M656 truck)
451F	Cargo box bilge pump switch to front cargo bilge pump (M656 truck)
451R	Cargo box bilge pump switch to rear cargo bilge pump (M656 truck)
452	Cab bilge pump circuit breakers to cab bilge pump switch (from circuit 450) (M656 truck)

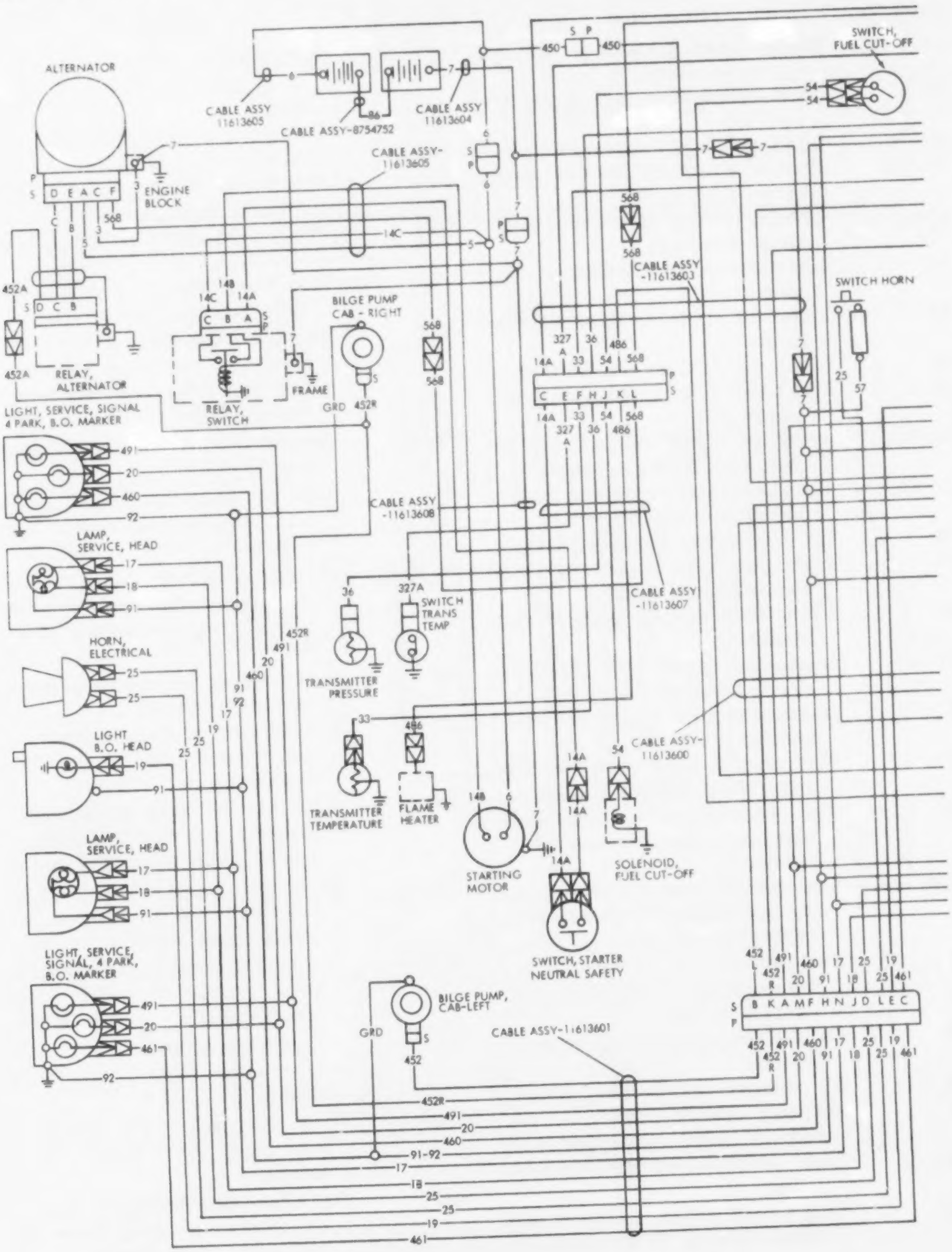
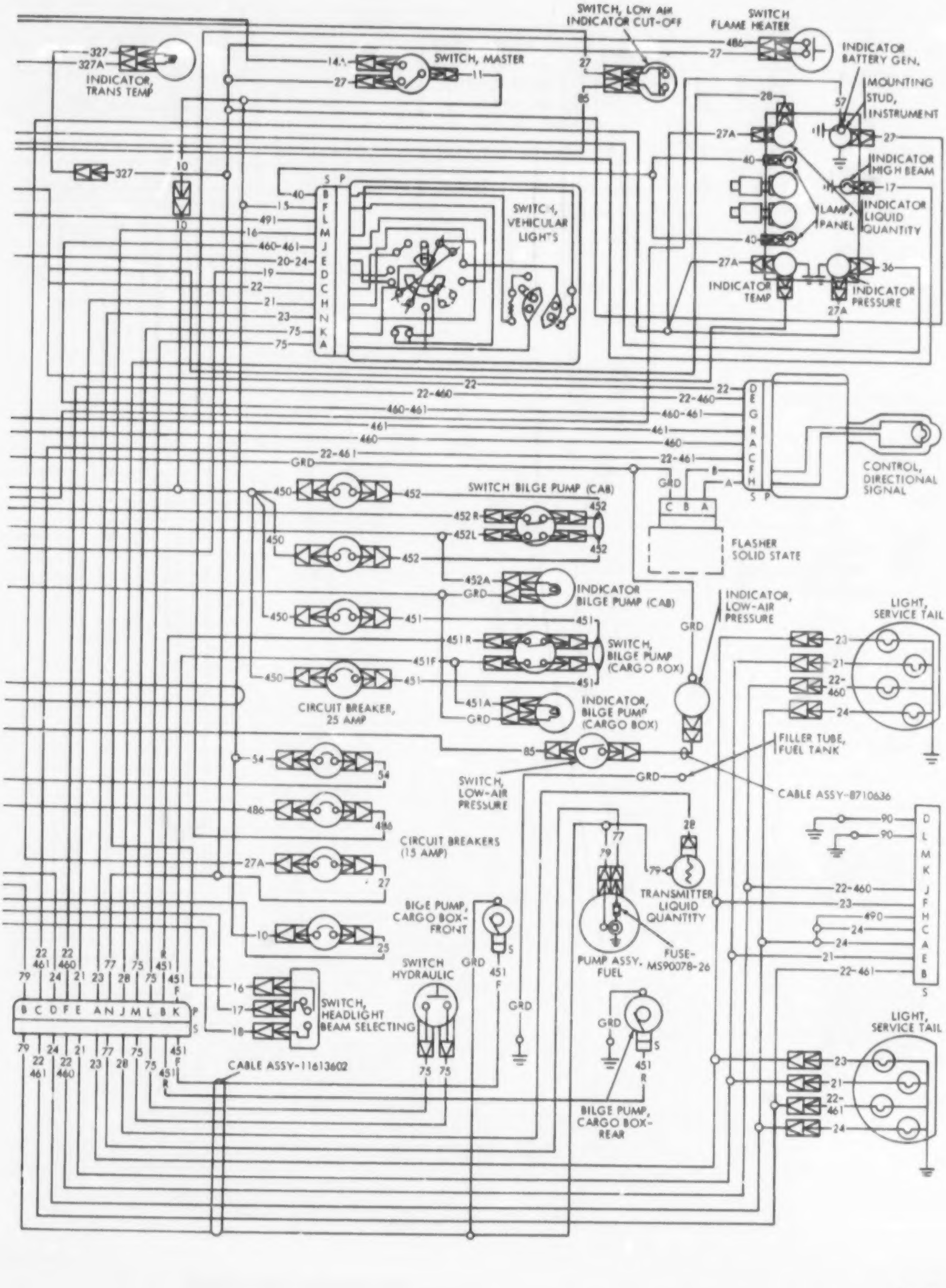

ALTERNATOR
ENGINE BLOCK
CABLE ASSY 11613605
CABLE ASSY-8754752
CABLE ASSY 11613604
CABLE ASSY-11613605
SWITCH, FUEL CUT-OFF
CABLE ASSY -11613603
SWITCH HORN
RELAY, ALTERNATOR
RELAY, SWITCH
FRAME
BILGE PUMP CAB - RIGHT
GRD
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
LAMP, SERVICE, HEAD
HORN, ELECTRICAL
LIGHT B.O. HEAD
LAMP, SERVICE, HEAD
LIGHT, SERVICE, SIGNAL, 4 PARK, B.O. MARKER
CABLE ASSY -11613608
CABLE ASSY -11613607
SWITCH TRANS TEMP
TRANSMITTER PRESSURE
TRANSMITTER TEMPERATURE
FLAME HEATER
STARTING MOTOR
SOLENOID, FUEL CUT-OFF
SWITCH, STARTER NEUTRAL SAFETY
CABLE ASSY-11613600
BILGE PUMP, CAB-LEFT
CABLE ASSY-11613601
452R
491
20
460
91-92
17
18
25
25
19
461

Figure 2–30. Wiring diagram and circuit identification, M656 truck.


SWITCH, LOW AIR INDICATOR CUT-OFF
SWITCH FLAME HEATER
INDICATOR BATTERY GEN.
INDICATOR, TRANS TEMP
SWITCH, MASTER
MOUNTING STUD, INSTRUMENT
INDICATOR HIGH BEAM
INDICATOR LIQUID QUANTITY
LAMP, PANEL
INDICATOR TEMP
INDICATOR PRESSURE
SWITCH, VEHICULAR LIGHTS
CONTROL, DIRECTIONAL SIGNAL
FLASHER SOLID STATE
SWITCH BILGE PUMP (CAB)
INDICATOR BILGE PUMP (CAB)
SWITCH, BILGE PUMP (CARGO BOX)
INDICATOR, BILGE PUMP (CARGO BOX)
CIRCUIT BREAKER, 25 AMP
INDICATOR, LOW-AIR PRESSURE
LIGHT, SERVICE TAIL
FILLER TUBE, FUEL TANK
SWITCH, LOW-AIR PRESSURE
CABLE ASSY-8710636
CIRCUIT BREAKERS (15 AMP)
BIGE PUMP, CARGO BOX-FRONT
SWITCH HYDRAULIC
TRANSMITTER LIQUID QUANTITY
PUMP ASSY. FUEL
FUSE-MS90078-26
SWITCH, HEADLIGHT BEAM SELECTING
CABLE ASSY-11613602
BILGE PUMP, CARGO BOX-REAR
LIGHT, SERVICE TAIL
GRD
B C D F E A N J M L B K
S P

AT 12603

Figure 2-80. Wiring diagram and circuit identification, M656 truck.

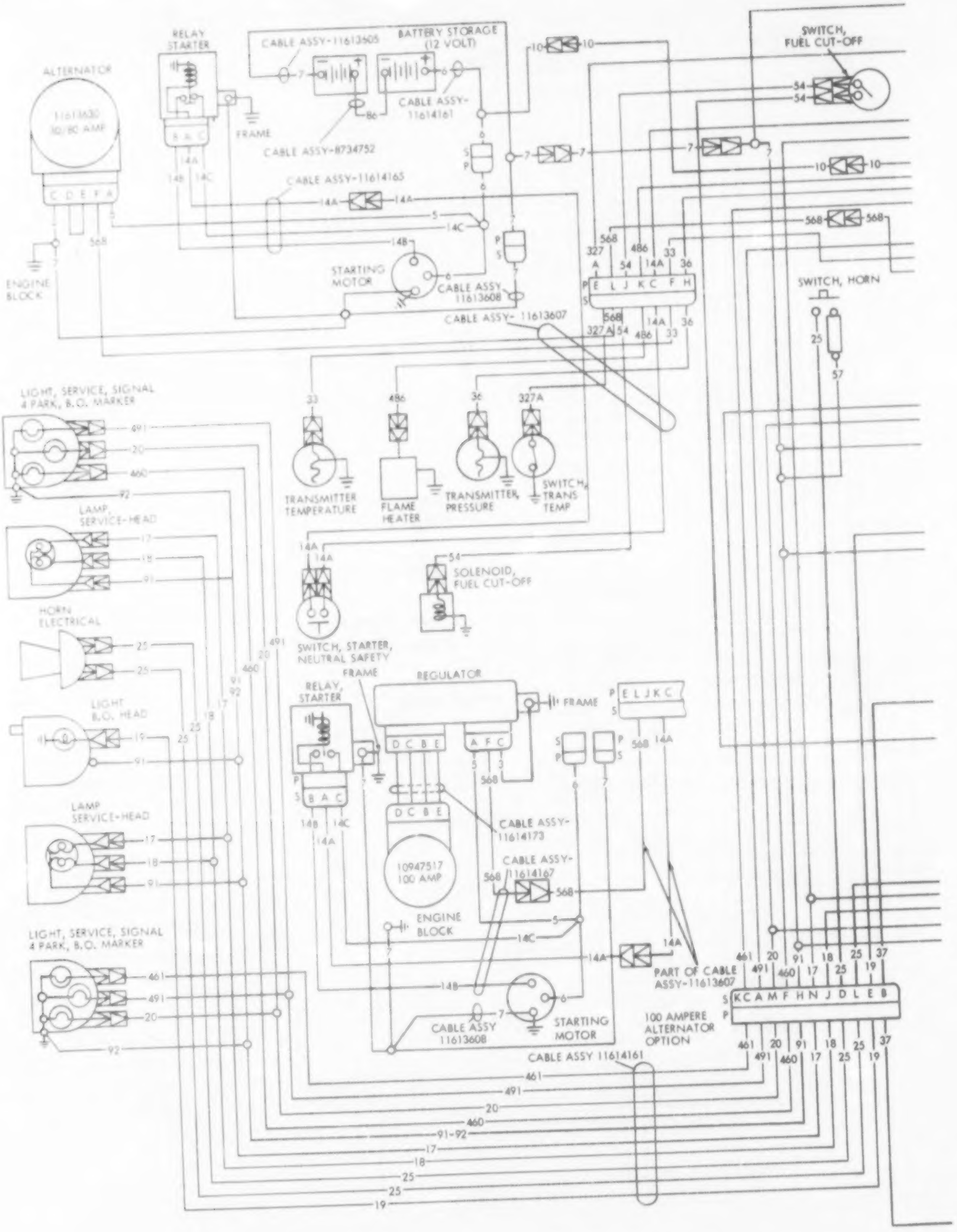
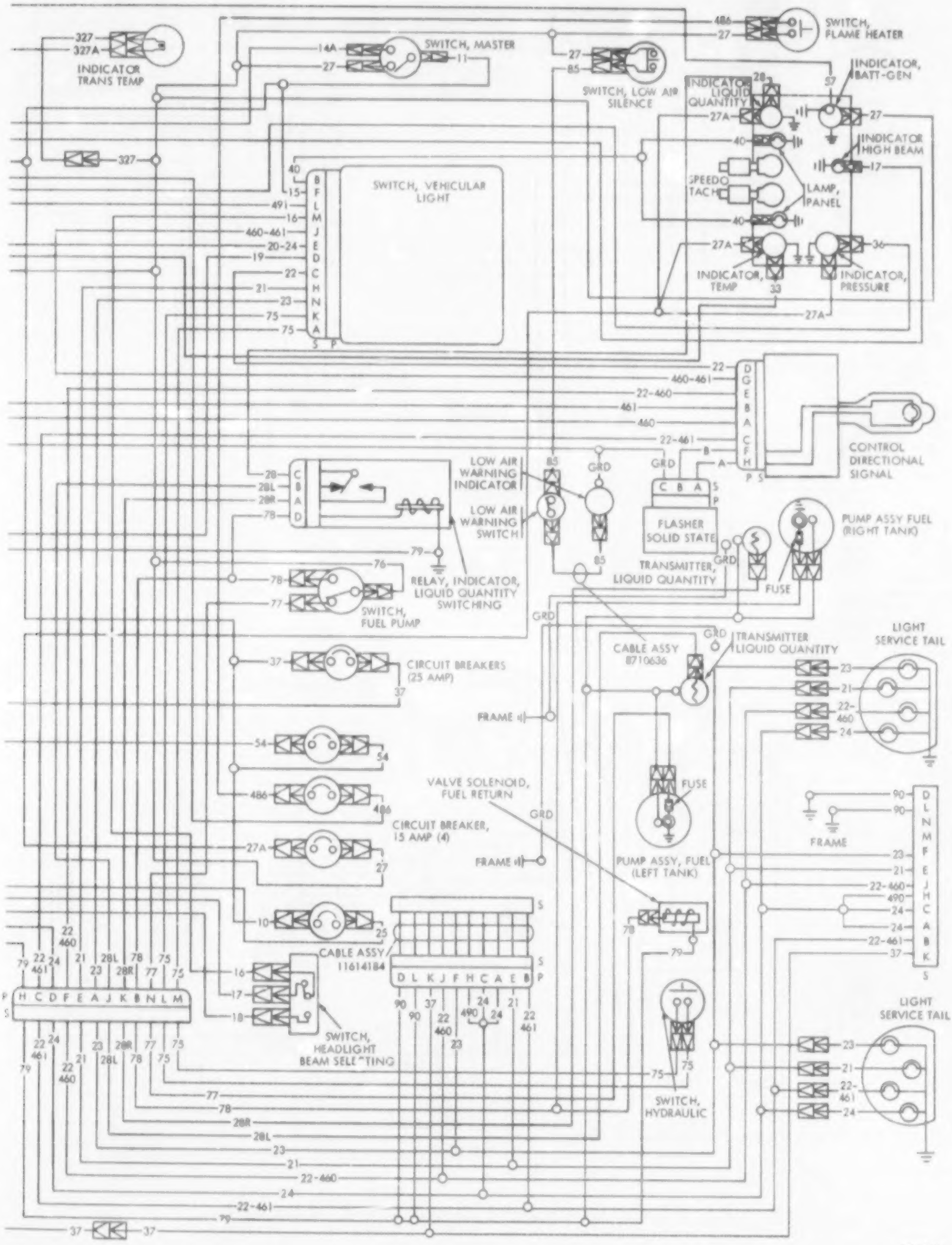

ALTERNATOR
11613630
30/60 AMP
C D E F A
ENGINE BLOCK
568
RELAY STARTER
B A C
14A
14B
14C
FRAME
CABLE ASSY-11613605
BATTERY STORAGE
(12 VOLT)
CABLE ASSY-11614161
CABLE ASSY-8734752
86
CABLE ASSY-11614165
STARTING MOTOR
CABLE ASSY 11613608
CABLE ASSY- 11613607
327
568
486
54
14A
33
36
P E L J K C F H
S
SWITCH, FUEL CUT-OFF
SWITCH, HORN
25
57
10
7
6
5
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
491
20
460
92
LAMP, SERVICE-HEAD
17
18
91
HORN ELECTRICAL
25
LIGHT B.O. HEAD
19
LAMP SERVICE-HEAD
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
461
TRANSMITTER TEMPERATURE
FLAME HEATER
TRANSMITTER, PRESSURE
SWITCH, TRANS TEMP
327A
SOLENOID, FUEL CUT-OFF
SWITCH, STARTER, NEUTRAL SAFETY
FRAME
REGULATOR
RELAY, STARTER
D C B E
A F C
10947517
100 AMP
CABLE ASSY-11614173
CABLE ASSY-11614167
ENGINE BLOCK
STARTING MOTOR
CABLE ASSY 11613608
PART OF CABLE ASSY-11613607
100 AMPERE ALTERNATOR OPTION
K C A M F H N J D L E B
461 20 91 18 25 37
491 460 17 25 19
CABLE ASSY 11614161
91-92

Figure 2-81. Wiring diagram and circuit identification, XM757 truck.


INDICATOR TRANS TEMP
SWITCH, MASTER
SWITCH, LOW AIR SILENCE
SWITCH, FLAME HEATER
INDICATOR, BATT-GEN
INDICATOR LIQUID QUANTITY
INDICATOR HIGH BEAM
SPEEDO
TACH
LAMP, PANEL
INDICATOR, TEMP
INDICATOR, PRESSURE
SWITCH, VEHICULAR LIGHT
CONTROL DIRECTIONAL SIGNAL
LOW AIR WARNING INDICATOR
LOW AIR WARNING SWITCH
FLASHER SOLID STATE
TRANSMITTER, LIQUID QUANTITY
PUMP ASSY FUEL (RIGHT TANK)
FUSE
RELAY, INDICATOR, LIQUID QUANTITY SWITCHING
SWITCH, FUEL PUMP
CABLE ASSY 8710636
TRANSMITTER LIQUID QUANTITY
LIGHT SERVICE TAIL
CIRCUIT BREAKERS (25 AMP)
FRAME
VALVE SOLENOID, FUEL RETURN
CIRCUIT BREAKER, 15 AMP (4)
PUMP ASSY, FUEL (LEFT TANK)
CABLE ASSY 11614184
SWITCH, HEADLIGHT BEAM SELECTING
SWITCH, HYDRAULIC
LIGHT SERVICE TAIL
GRD

AT 12604

Figure 2-81. Wiring diagram and circuit identification, XM757 truck.

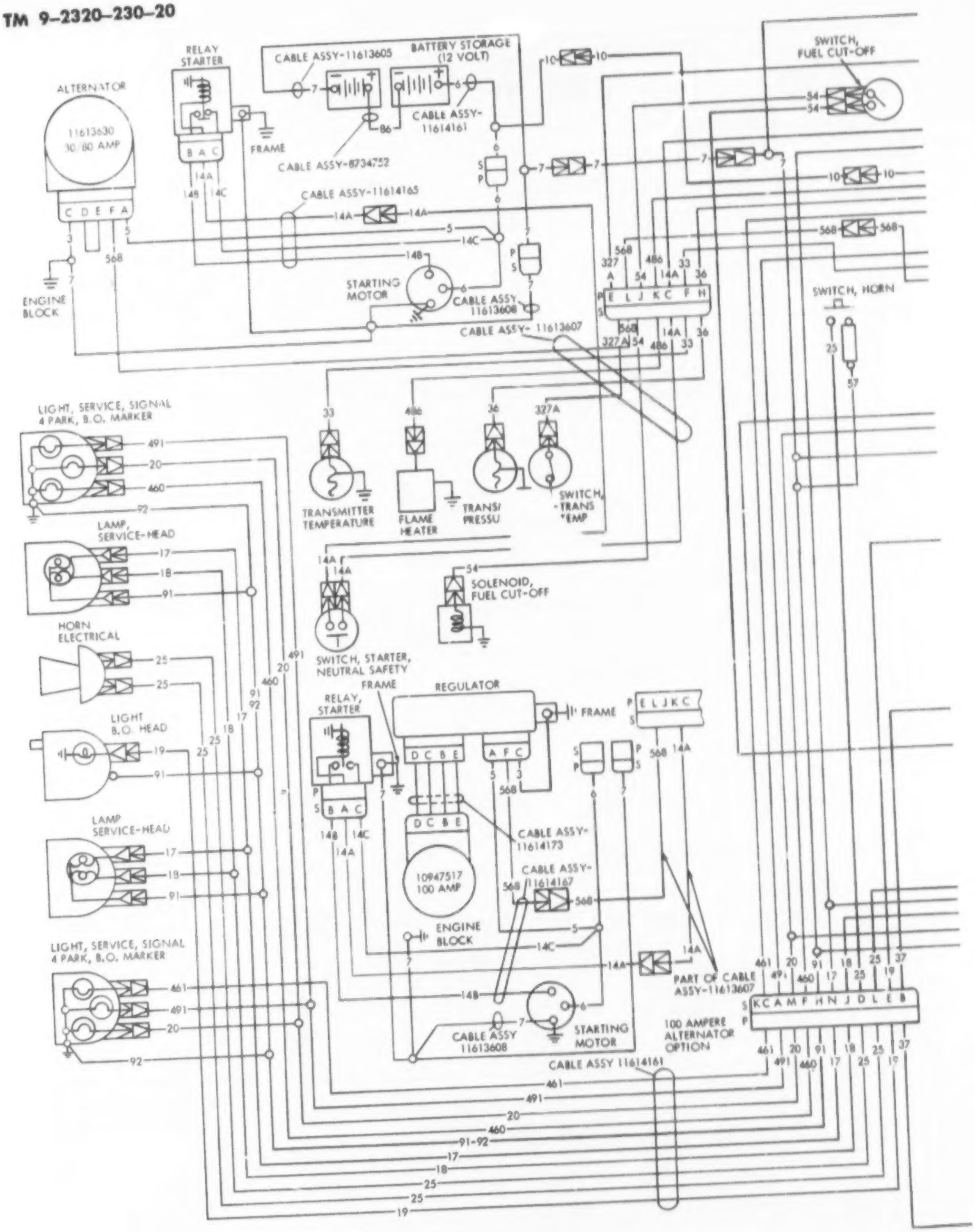

ALTERNATOR
11613630
30/80 AMP
C D E F A
ENGINE BLOCK
RELAY STARTER
B A C
14A
14B
14C
FRAME
CABLE ASSY-11613605
BATTERY STORAGE (12 VOLT)
CABLE ASSY-8734752
CABLE ASSY-11614161
CABLE ASSY-11614165
STARTING MOTOR
CABLE ASSY 11613608
CABLE ASSY- 11613607
SWITCH, FUEL CUT-OFF
SWITCH, HORN
LIGHT, SERVICE, SIGNAL 4 PARK, B.O. MARKER
LAMP, SERVICE-HEAD
HORN ELECTRICAL
LIGHT B.O. HEAD
TRANSMITTER TEMPERATURE
FLAME HEATER
TRANS/ PRESSU
SWITCH, -TRANS TEMP
SWITCH, STARTER, NEUTRAL SAFETY
SOLENOID, FUEL CUT-OFF
REGULATOR
D C B E
A F C
10947517
100 AMP
CABLE ASSY-11614173
CABLE ASSY-11614167
PART OF CABLE ASSY-11613607
100 AMPERE ALTERNATOR OPTION
CABLE ASSY 11614161
K C A M P H N J D L E B
E L J K C F H
327A 568 54 486 14A 33 36
461 491 20 460 91-92 17 18 25 19 37

Figure 2-82. Wiring diagram and circuit identification, XM791 truck.

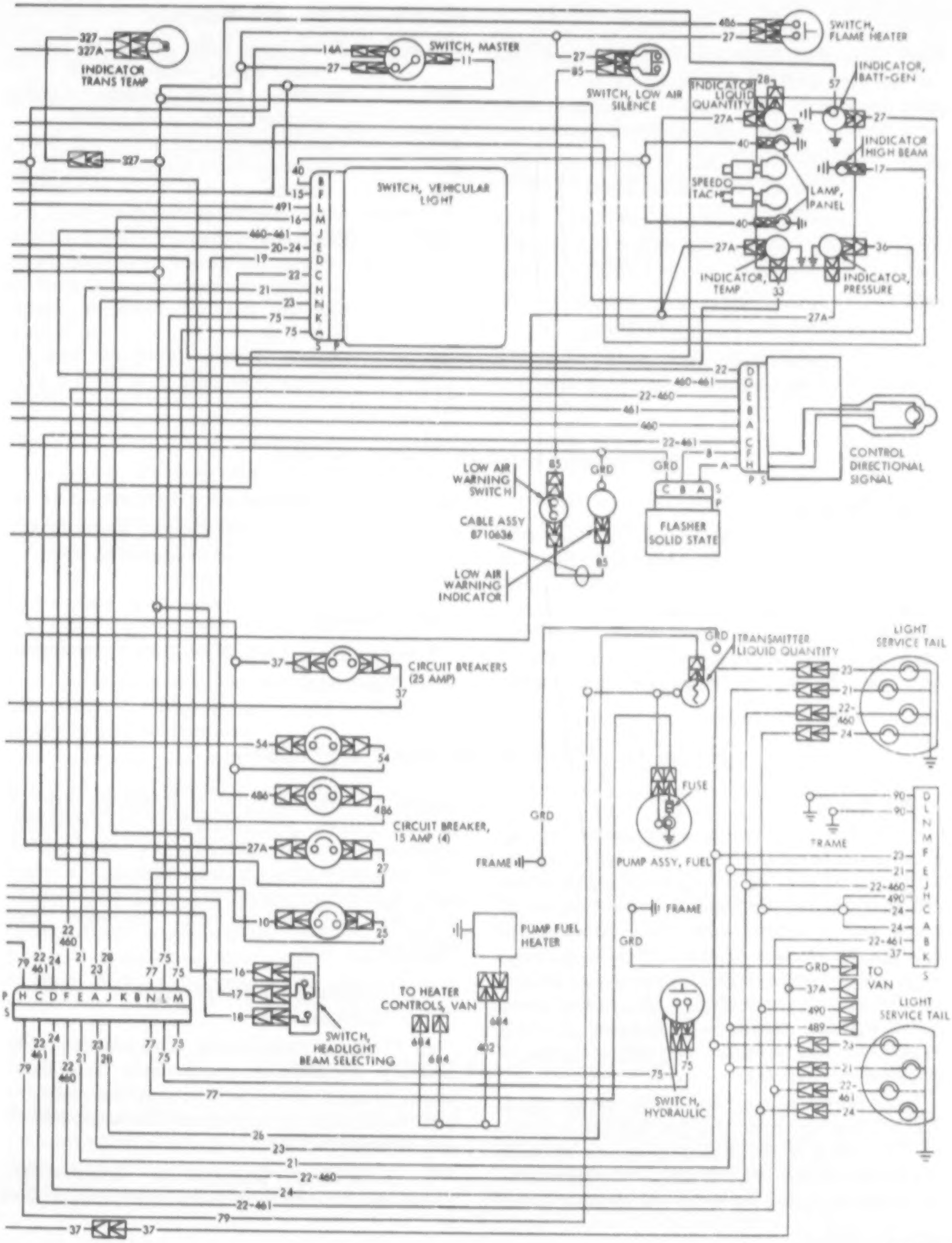

INDICATOR TRANS TEMP
SWITCH, MASTER
SWITCH, FLAME HEATER
SWITCH, LOW AIR SILENCE
INDICATOR LIQUID QUANTITY
INDICATOR, BATT-GEN
INDICATOR HIGH BEAM
SPEEDO
TACH
LAMP, PANEL
INDICATOR, TEMP
INDICATOR, PRESSURE
SWITCH, VEHICULAR LIGHT
CONTROL DIRECTIONAL SIGNAL
FLASHER SOLID STATE
LOW AIR WARNING SWITCH
CABLE ASSY 8710636
LOW AIR WARNING INDICATOR
GRD
CIRCUIT BREAKERS (25 AMP)
CIRCUIT BREAKER, 15 AMP (4)
FRAME
TRANSMITTER LIQUID QUANTITY
FUSE
PUMP ASSY, FUEL
LIGHT SERVICE TAIL
PUMP FUEL HEATER
TO HEATER CONTROLS, VAN
SWITCH, HEADLIGHT BEAM SELECTING
SWITCH, HYDRAULIC
TO VAN
LIGHT SERVICE TAIL
AT 12605

Figure 2-82. Wiring diagram and circuit identification, XM791 truck.

Circuit No.	Description
452A	Alternator relay coil (from 452R) (M656 truck)
452A	Cab bilge pump indicator light (from 452L) (M656 truck)
452R	Cab bilge pump switch to right hand cab bilge pump (M656 truck)
452L	Cab bilge pump switch to left hand cab bilge pump (M656 truck)
460	Directional control switch to left front turn signal lamp
461	Directional signal control switch to right front turn signal lamp
460–461	Feed from light switch to directional signal control switch
486	Manifold heater switch, circuit breaker to manifold heater
489	Clearance light circuit to van body
489	Clearance light circuit from light switch to van body connector (connected to circuit 21)
490	Blackout taillamp circuit from light switch to van body connector (connected to circuit 24)
491	Service parking lamp to light switch
568	Master switch to 30–80 ampere alternator field (via circuit 27)

Section VIII. FIELD EXPEDIENT REPAIRS

2-28. General

Organizational maintenance troubles may occur while the vehicle is operating in the field where supplies and repair parts are not available and normal corrective action cannot be performed. When this condition exists, the following expedient repairs may be used in emergencies, upon the decision of the unit commander. Equipment so repaired must be removed from operation as soon as possible and properly repaired before being placed in operation again.

2-29. Repairs

Refer to TM 9-2320-230-10 for Field Expedient Repairs.

Section IX. RADIO INTERFERENCE SUPPRESSION

2-30. Purpose

a. Radio interference suppression is the elimination or minimizing of the electrical disturbances in the radio frequency range which are generated by the engine and vehicle accessories and interfere with radio reception or disclose the location of the vehicle to sensitive electrical detectors. It is important that electrical disturbances in vehicles with, as well as vehicles without, radios be suppressed properly to prevent interference with radio reception of neighboring vehicles.

b. Suppression in the M656 cargo truck, XM757 tractor truck and the XM791 expansible van truck is accomplished by use of radio frequency filters and capacitors (condensers). In addition, metal parts in the vicinity of the engine are formed into a shield by use of ground cables, and tooth-type lockwashers, confining electrical disturbances so they cannot disturb receiving equipment. Wiring that may carry interfering surges to a point where interferences will affect radio reception are shielded.

2-31. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference such as frequency filters, capacitors and shielded wiring.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental and/or secondary to their primary functions such as ground cables and star washers.

2-32. Description

The systems listed below have been treated to accomplish suppression of radio interference.

a. Ignition System. The major source of radio interference in military vehicles is from high-voltage ignition systems. Since diesel engines do not use electrical ignition, spark discharge interference does not exist in these trucks.

b. Generating (Charging) System. Radio frequency filters have been included in the construction of the alternator and regulator to eliminate rotary brush interference.

c. Engine Manifold Heater System. Shielding and filtering of the ignition (spark plug) circuit has been included in the construction to eliminate spark interference.

d. Bilge Pump System. The bilge pumps are constructed with a shielded frame and radio frequency filters to eliminate rotary brush interference.

e. Starting System. The starting system components are shielded and grounded to eliminate rotary brush interference.

f. Accessory and Auxiliary Equipment. All accessory and auxiliary equipment is constructed to specifications requiring suppression of radio frequency interference.

2-33. Fasteners and Ground Cables

Ground cables are used where necessary to unite critical parts thereby forming a solid electrical circuit to conduct radio interference currents directly to the vehicle ground and away from antennas. Tooth-type lockwashers are installed at all ground cables and critical electrical component ground connections. It is important that all bond straps be in good condition, that all tooth-type lockwashers be installed, and that all retaining capscrews and nuts be tightened to form a good ground connection. Scrape all contacting metal surfaces clean before tightening ground cables.

2-34. Test for Radio Interference

The overall efficiency of the radio interference suppression system may be tested as follows:

a. Bring a radio-equipped vehicle within 25 feet of the truck to be tested. Shut off its engine and turn on its radio equipment for maximum sensitivity.

b. Turn on the radio equipment in the test truck, if so equipped.

c. Start the truck engine and turn on all auxiliary equipment. No increase in background noise in either the truck equipment or the nearby vehicle should be heard.

d. If noise is heard in either radio equipment, turn off or disconnect electrical generating or operating components one at a time until the noise stops.

e. When a component is found which causes radio interference, check it carefully for loose connections, secure mountings, missing toothed washers, or damaged or broken metal housing. The capacitors may be checked for leaks and shorts on a multimeter.

f. If the interference cannot be eliminated with thorough cleaning and minor repairs, replace the component.

g. If radio interference still is present, repeat operation *d* above. More than one component may be causing interference.

Section X. POWER PLANT REPLACEMENT

2-35. Description

The following is a general description of the three major components that make up the power plant assembly (fig. 2-83).

Note. The power plant, as such, is not a supply item. therefore, it should not be removed from the vehicle by organizational maintenance personnel unless authorized by direct support maintenance.

best copy available

Reproduced from poor document.

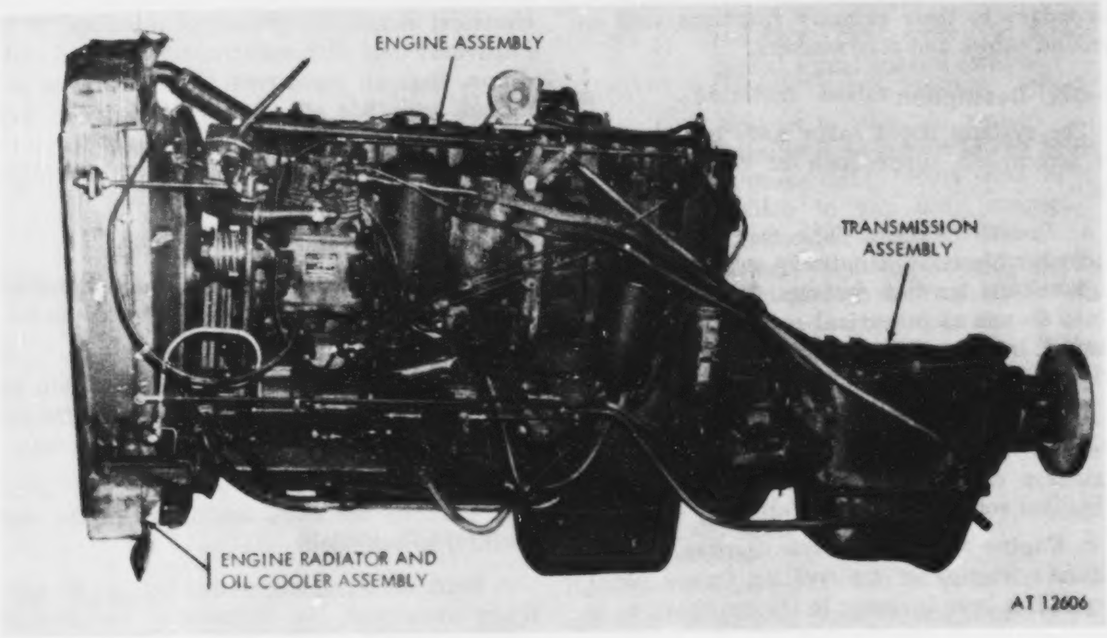


Figure 2-83. Power plant assembly, left side view.

a. Engine. The engine (fig. 2-84) is a 6-cylinder, 4-cycle, overhead valve, liquid-cooled, multifuel, compression-ignition engine, which is mounted between the frame side rails at the front of the vehicle. For detailed description of the engine accessories which are components of the fuel, air intake, exhaust, cooling, starting, generating and compressed air systems, refer to the appropriate sections of this chapter.

b. Transmission. The transmission (fig. 2-85) is a hydraulically operated automatic transmission that incorporates a torque converter with automatic lockup clutch and planetary gearing which provides six speeds forward and one reverse.

c. Engine Radiator and Transmission Oil Cooler Assembly. The engine radiator, transmission oil cooler and fan shroud assembly (fig. 2-86) is mounted with insulators secured to the engine and radiator support assembly and is supported on each upper side by an insulated rod attached to the transmission selector and radiator bracket.

2-36. Power Plant Mounting

The power plant is secured to the vehicle frame at three points (fig. 2-87). The rear mounting brackets of the power plant are attached to the engine flywheel housing and rest in rubber insulators attached to the top side of the vehicle frame side rails. The front of the power plant is attached to the support assembly which rests in a rubber insulator attached to a bracket welded to the front crossmember.

2-37. Power Plant Removal

a. Preliminary Operations.

(1) Position vehicle under suitable engine lifting equipment. Block vehicle wheels to prevent vehicle from moving.

(2) Tilt co-driver's seat forward and open battery box cover (fig. 2-88). Disconnect battery negative ground cable (fig. 2-89) and tape end of cable to eliminate hazard of accidental contact to battery post. Place cable alongside battery and close battery box cover.

(3) Open air reservoir drain cock (fig. 2-90) and drain vehicle air system.

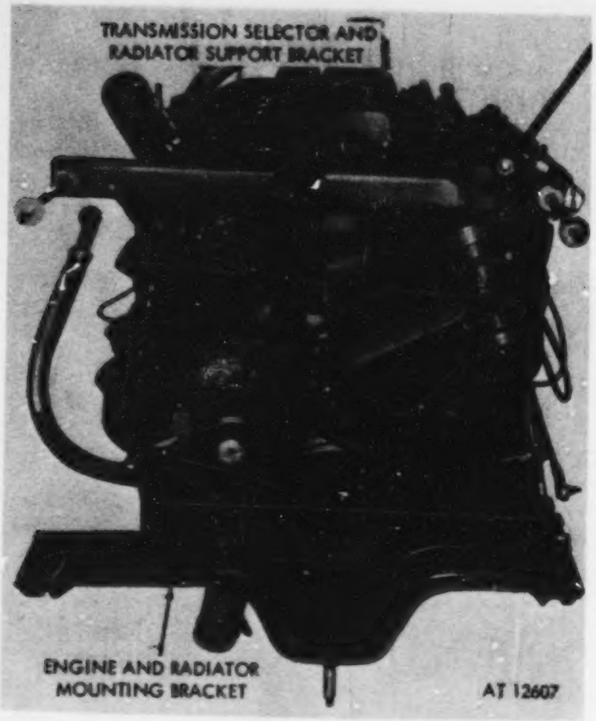

TRANSMISSION SELECTOR AND RADIATOR SUPPORT BRACKET
ENGINE AND RADIATOR MOUNTING BRACKET
AT 12607

Figure 2-84. Engine assembly, front view.

(4) Remove cab soft top (TM 9-2320-230-10) and stow bows and canvas in cargo box.

(5) Remove windshield and stow in windshield stowage box. Refer to TM 9-2320-230-10.

(6) Remove brush guard. Refer to paragraph 2-210 for removal procedures.

(7) If vehicle is equipped with a winch, refer to paragraph 2-262 and disconnect drive shaft from winch gearbox input shaft. Raise drive shaft and secure end of shaft to upper right bulkhead (fig. 2-91).

(8) Remove engine hatch covers (fig. 2-92).

(*a*) Release eight fasteners and remove engine rear hatch cover.

(*b*) Remove transmission gear selector knob, shift position pointer and lockwasher.

(*c*) Release four fasteners and remove engine front hatch cover.

(9) Remove cab front crossmember. Refer to paragraph 2-76.

b. Disconnect Procedures for Right Side of Engine.

(1) Disconnect three electrical connectors at receptacles mounted to right bulkhead (fig. 2-93), and starter relay connector and ground lead on frame right side rail.

(2) Loosen air compressor intake hose clamp and disconnect air hose from fitting on right bulkhead (fig. 2-93).

(3) Loosen turbocharger air intake elbow hose clamp and disconnect elbow from fitting on right bulkhead (fig. 2-93).

(4) Loosen exhaust pipe clamp at rear of front exhaust pipe assembly and slide clamp onto the intermediate exhaust pipe.

c. Disconnect Procedures for Left Side of Engine.

(1) Disconnect tachometer cable assembly from adapter on left bulkhead.

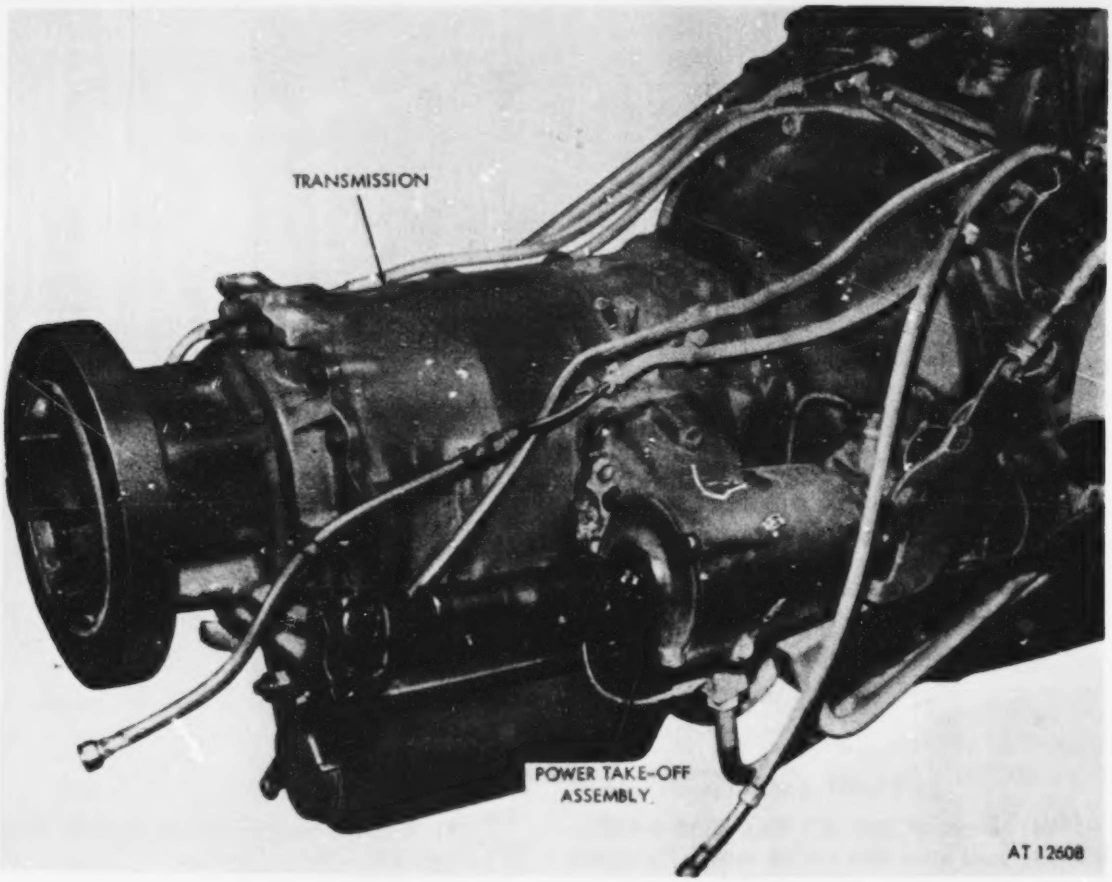


Figure 2–85. Transmission assembly, right side view.

(2) Remove nut, lockwasher and bolt securing accelerator rod to accelerator control arm on forward lower end of engine left bulkhead (fig. 2–94). Secure accelerator rod to engine with wire to prevent damage during engine removal.

(3) Disconnect power steering oil pressure hose from power steering pump outlet line elbow (fig.–295). Drain power steering fluid and protect openings from contamination.

d. Disconnect Procedures Under Power Plant.

(1) Disconnect power steering reservoir return hose (fig. 2–96) from fitting secured to the left frame side rail (fig. 2–97). Drain power steering fluid and protect openings from contamination.

(2) Disconnect fuel inlet and fuel return hoses (fig. 2–97) from fittings on fuel manifold mounted on left frame rail. Drain fuel lines and protect all fuel openings from contamination.

(3) Remove nut, external tooth washer and bolt securing engine starter ground cable (fig. 2–98) to right frame side rail.

(4) Disconnect electrical harness at connector of starter relay mounted on inner side of right frame rail (fig. 2–99).

(5) Loosen clamp and disconnect engine front exhaust pipe (fig. 2–100) from front intermediate exhaust pipe. Discard gasket.

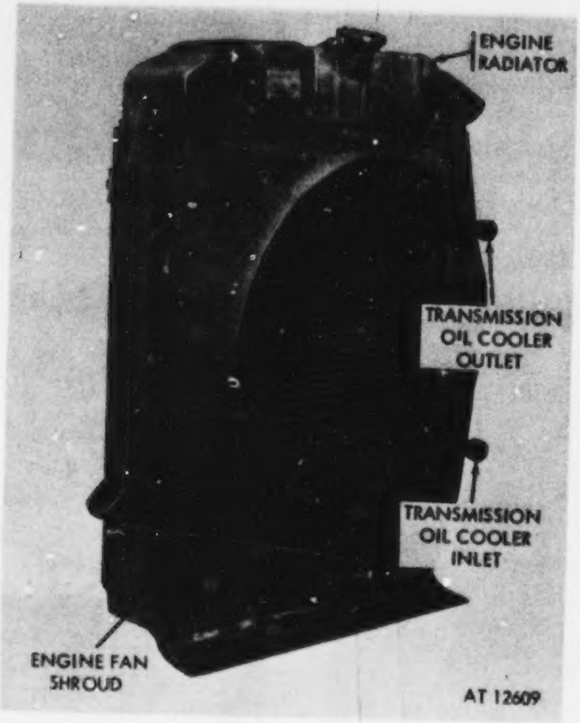


Figure 2-86. Engine radiator, transmission oil cooler and fan shroud assembly.

(6) Disconnect air governor unload line from air hose connector to air governor (fig. 2-101).

Warning: **Before disconnecting air lines, alternately open drain cocks on air reservoir tanks to drain all air from the system.**

(7) Disconnect shielded air hose from air compressor main air line secured to right side of transmission (fig. 2-101).

(8) Disconnect engine air pressurization hose from fitting on air manifold mounted at right rear of cab (fig. 2-102).

(9) Disconnect air pressurization hose from air line secured to left side of transmission (fig. 2-103).

(10) Separate propeller shaft universal joint from transmission output flange (fig. 2-104) and tie shaft to side of frame rail.

Note. Bearing cups should be kept clean and taped on universal joint spider.

(11) When the vehicle is equipped with front end winch, refer to section XXXV for disconnect procedures of the transmission mounted power takeoff.

(12) Attach lifting sling (4910-789-7584) to lifting eyes of engine (fig. 2-105). Use a hoist of 2-ton capacity or over and remove slack from lifting chain or hoist.

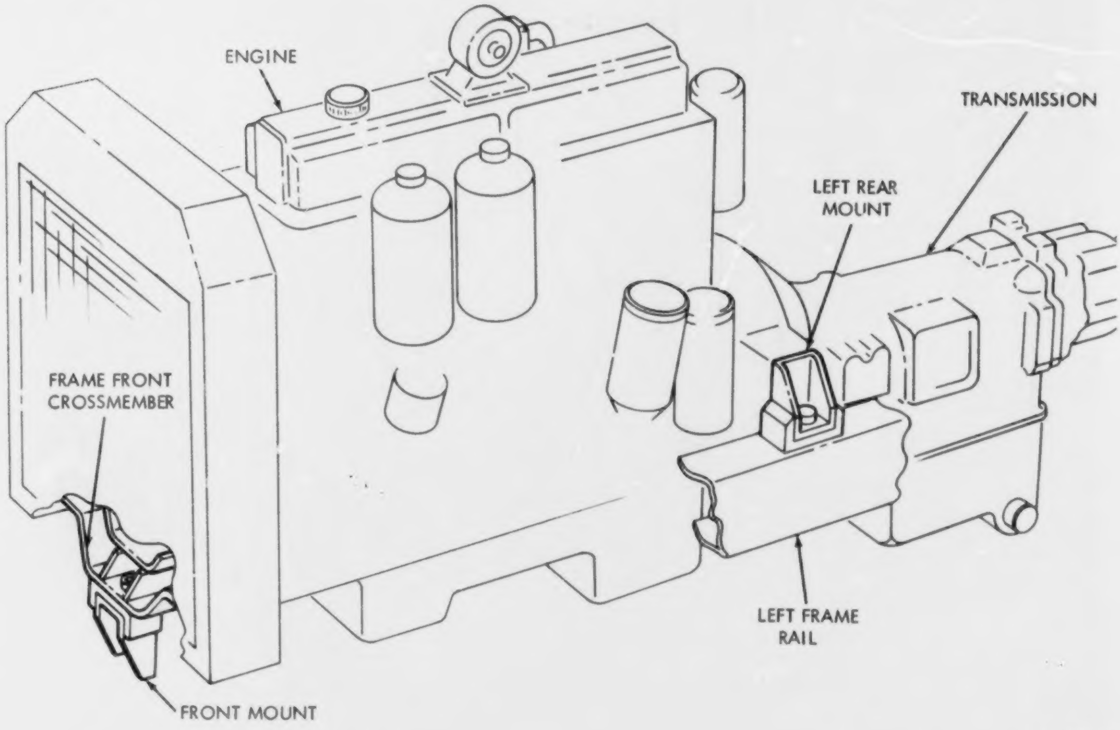
Note. Lifting sling must be adjusted so that front of engine will tilt slightly upward when lifted.

(13) Remove two cotter pins, nuts, bolts and rubber insulators securing the right and left rear engine mounting brackets to the vehicle frame side rails (fig. 2-106).

(14) Remove cotter pin, nut and rubber insulator from bolt of front engine mount (fig. 2-107).

Note. Bolt remains captive to engine mount bracket.

(15) Slowly lift power plant up and forward, making sure all lines and harnesses are


ENGINE
TRANSMISSION
LEFT REAR MOUNT
FRAME FRONT CROSSMEMBER
LEFT FRAME RAIL
FRONT MOUNT

AT 12610

Figure 2-87. Power plant mountings.

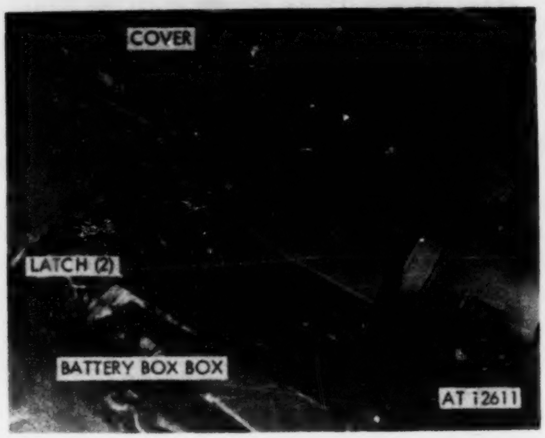

COVER
LATCH (2)
BATTERY BOX BOX
AT 12611

Figure 2-88. Battery box and cover.

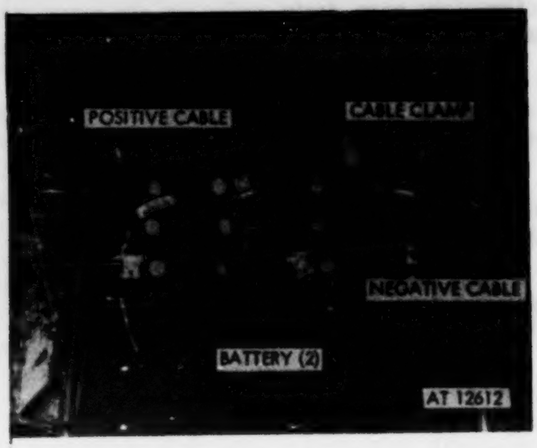

POSITIVE CABLE
CABLE CLAMP
NEGATIVE CABLE
BATTERY (2)
AT 12612

Figure 2-89. Batteries and battery cables.

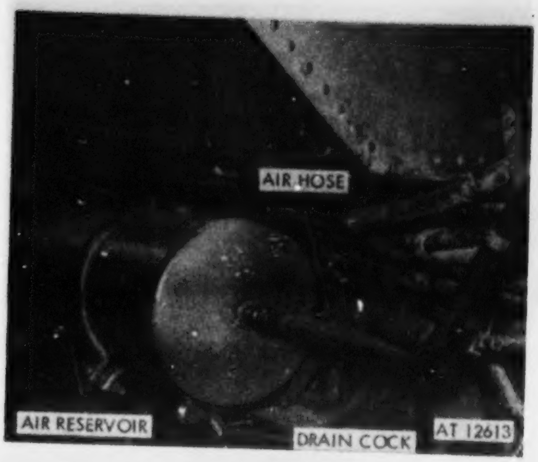

AIR HOSE
AIR RESERVOIR
DRAIN COCK
AT 12613

Figure 2-90. Air reservoir and drain cock, typical.

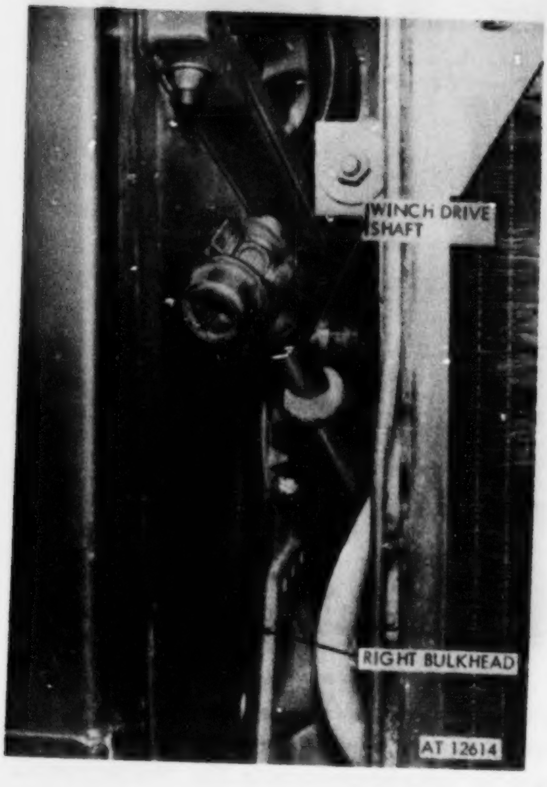

WINCH DRIVE SHAFT
RIGHT BULKHEAD
AT 12614

Figure 2-91. Winch drive shaft secured to engine bulkhead.

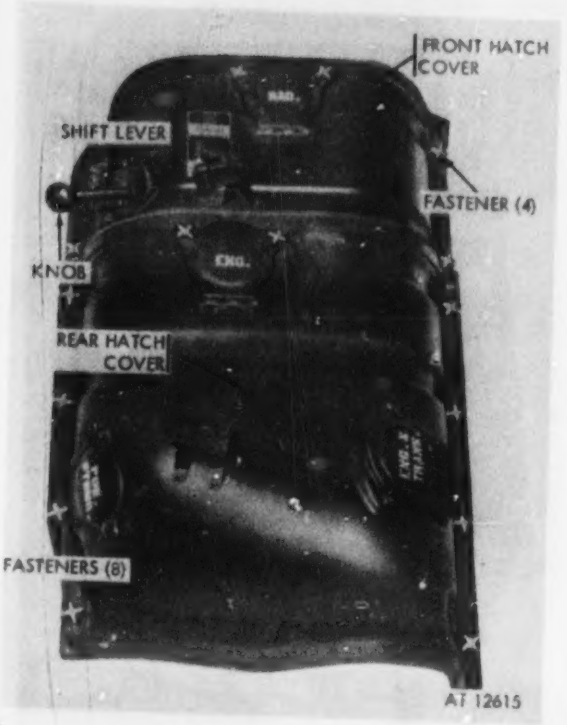

FRONT HATCH COVER
SHIFT LEVER
FASTENER (4)
KNOB
REAR HATCH COVER
FASTENERS (8)
AT 12615

Figure 2-92. Engine hatch covers.

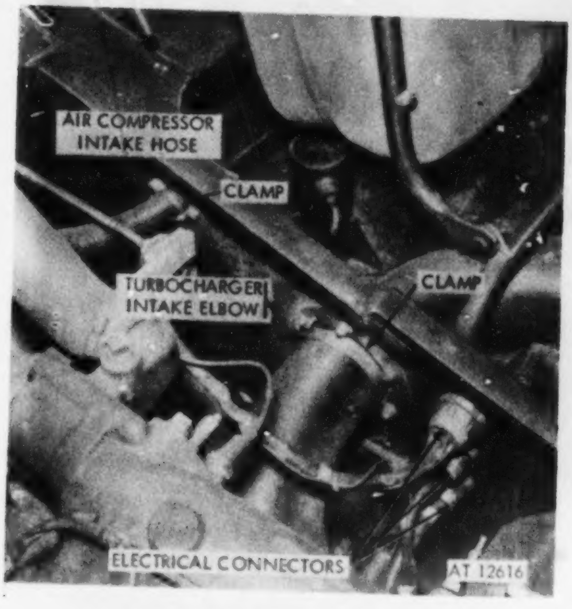

AIR COMPRESSOR INTAKE HOSE
CLAMP
TURBOCHARGER INTAKE ELBOW
CLAMP
ELECTRICAL CONNECTORS
AT 12616

Figure 2-93. Engine right bulkhead.

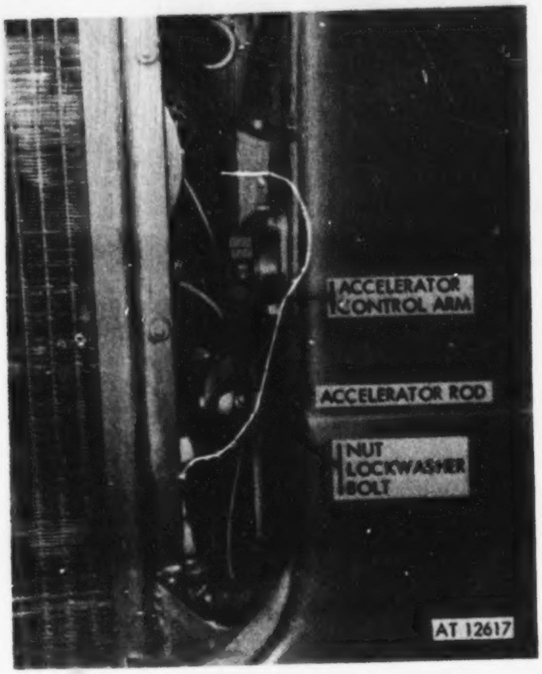

ACCELERATOR CONTROL ARM
ACCELERATOR ROD
NUT
LOCKWASHER
BOLT
AT 12617

Figure 2-94. Forward side of left bulkhead.

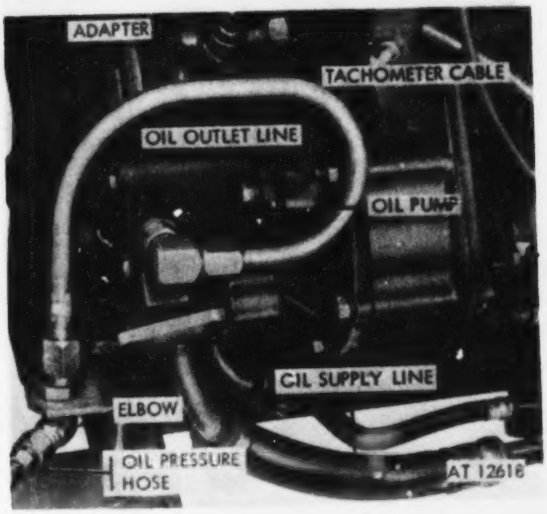

ADAPTER
TACHOMETER CABLE
OIL OUTLET LINE
OIL PUMP
OIL SUPPLY LINE
ELBOW
OIL PRESSURE HOSE
AT 12618

Figure 2-95. Power steering oil pump and oil pressure hose.

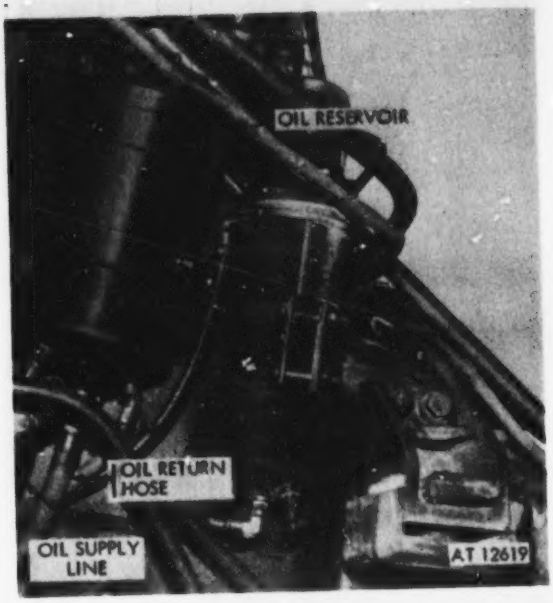

OIL RESERVOIR
OIL RETURN HOSE
OIL SUPPLY LINE
AT 12619

Figure 2-96. Power steering oil reservoir and oil return hose.

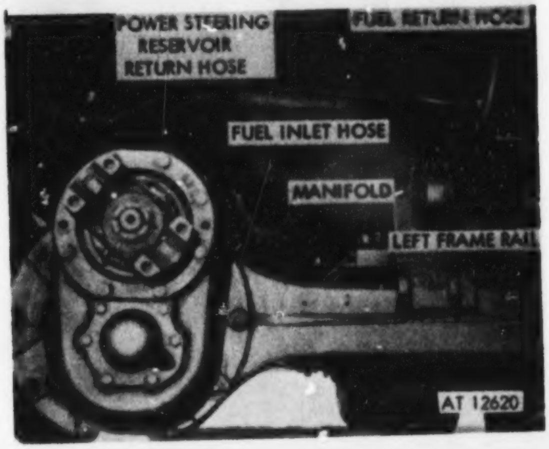

POWER STEERING RESERVOIR RETURN HOSE
FUEL RETURN HOSE
FUEL INLET HOSE
MANIFOLD
LEFT FRAME RAIL
AT 12620

Figure 2-97. Engine fuel inlet and return hoses.

disconnected from the vehicle and that there are no interferences with the vehicle components. Remove power plant from vehicle (fig. 2-108).

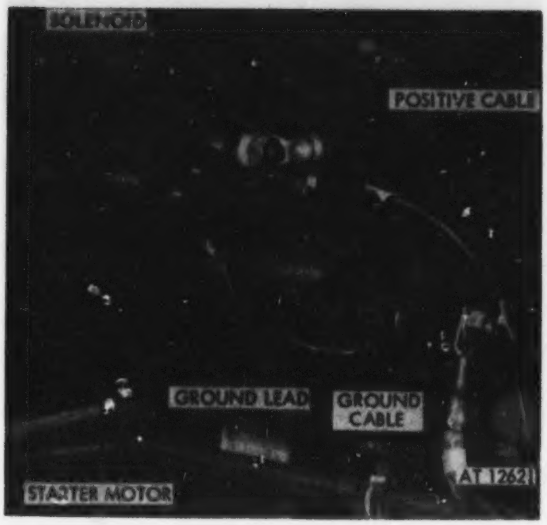

SOLENOID
POSITIVE CABLE
GROUND LEAD
GROUND CABLE
AT 12621
STARTER MOTOR

Figure 2-98. Engine starter assembly and ground cable.

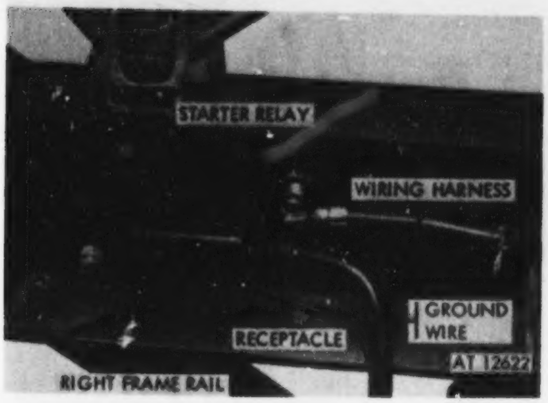

STARTER RELAY
WIRING HARNESS
GROUND WIRE
RECEPTACLE
AT 12622
RIGHT FRAME RAIL

Figure 2-99. Starter relay.

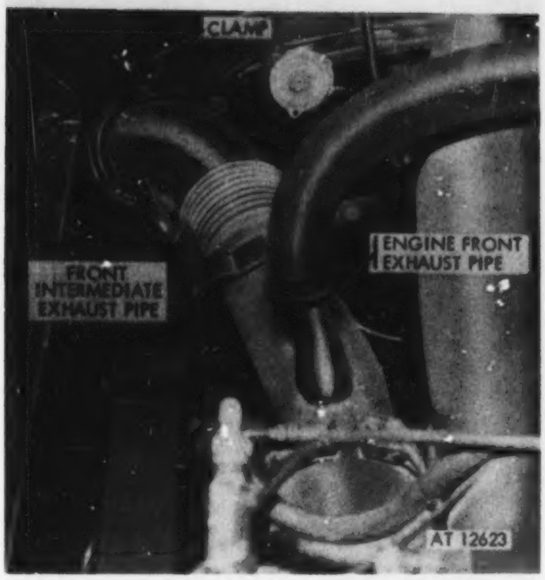

CLAMP
ENGINE FRONT EXHAUST PIPE
FRONT INTERMEDIATE EXHAUST PIPE
AT 12623

Figure 2-100. Engine front exhaust pipe.

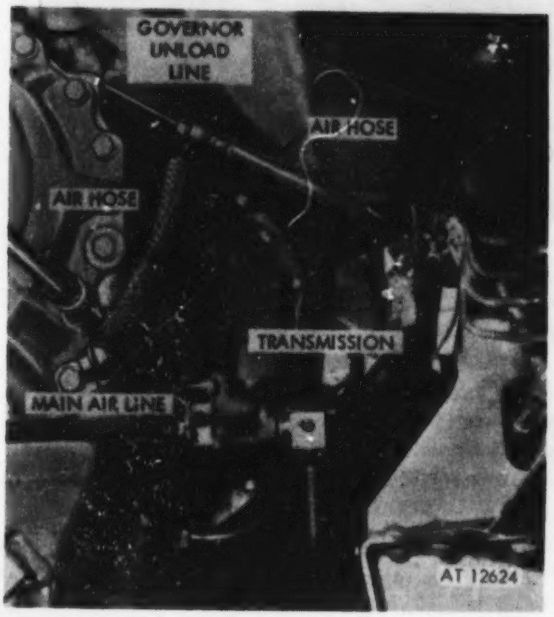

GOVERNOR UNLOAD LINE
AIR HOSE
AIR HOSE
TRANSMISSION
MAIN AIR LINE
AT 12624

Figure 2-101. Main air line and air governor line disconnect points.

(16) Place power plant on engine stand (fig. 2-109) or on blocks.

2-38. Transmission Removal

Note. Obtain approval of direct support maintenance personnel prior to separation of transmission from engine assembly.

a. General. Before the transmission assembly can be separated from the engine assembly, the

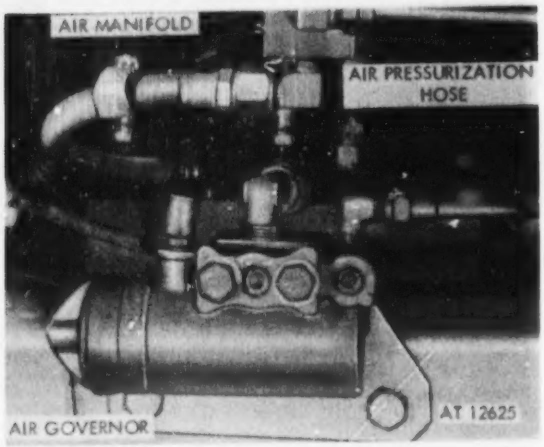

AIR MANIFOLD
AIR PRESSURIZATION HOSE
AIR GOVERNOR
AT 12625

Figure 2-102. Air governor and air manifold.

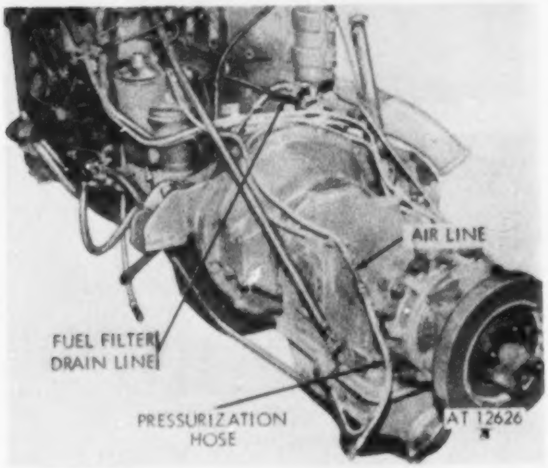

AIR LINE
FUEL FILTER DRAIN LINE
PRESSURIZATION HOSE
AT 12626

Figure 2-103. Air pressurization hose, left side of transmission.

power plant must be removed from the vehicle. Refer to paragraph 2-37.

b. Preliminary Procedures. The power plant should be mounted on engine stand with the transmission extending beyond the rear of the stand (fig. 2-109). Use lifting sling (7083778) and hoist or a floor jack to support the transmission during the separation operation.

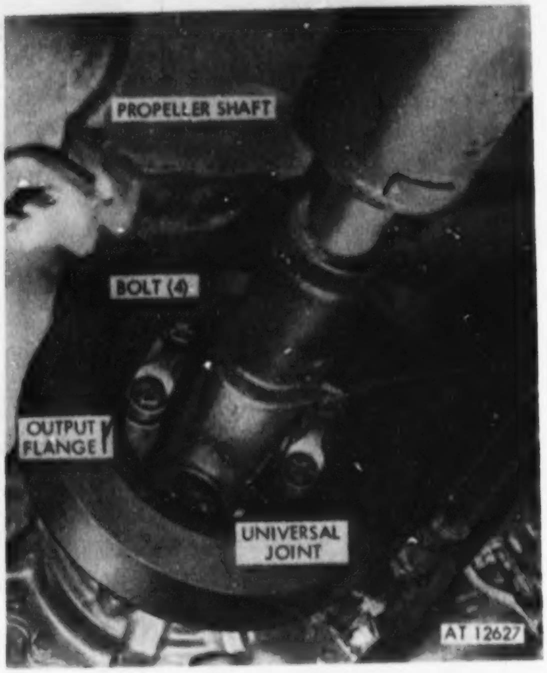

PROPELLER SHAFT
BOLT (4)
OUTPUT FLANGE
UNIVERSAL JOINT
AT 12627

Figure 2-104 Main propeller shaft front universal joint.

c. Separation Procedures.

(1) Remove drain plug (fig. 2-110) and drain transmission oil in clean container. Install plug.

(2) Remove screw, lockwasher and clamp securing air pressurization line to top left side of transmission housing (fig. 2-110).

(3) Disconnect transmission pressurization air hose from elbow fitting on transmission housing (fig. 2-110).

(4) Remove two cotter pins and clevis pins and disconnect throttle valve control rod and transmission shift control rod from transmission shift arms (fig. 2-111).

(5) Remove two screws, lockwashers and three clamps securing air compressor main air supply line and air governor control line to right side of transmission housing (fig. 2-112).

(6) Disconnect electrical lead from oil temperature transmitter (fig. 2-113).

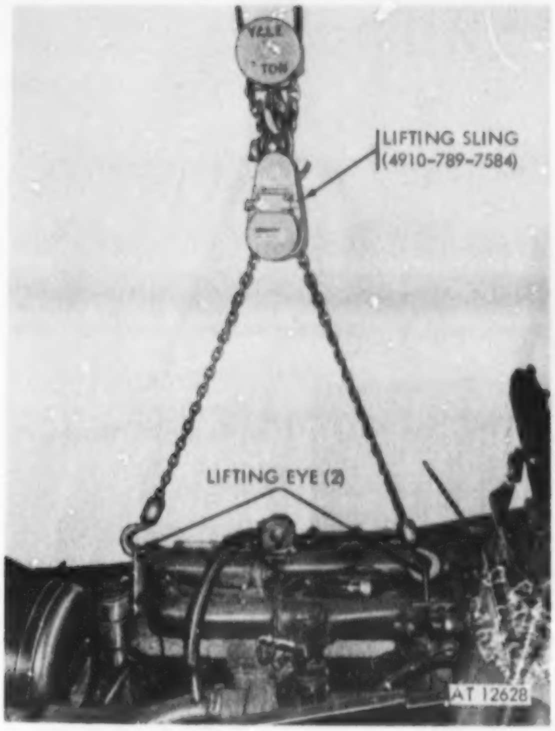

LIFTING SLING
(4910–789–7584)
LIFTING EYE (2)
AT 12628

Figure 2–105. Lifting sling (4910–789–7584) attached to engine.

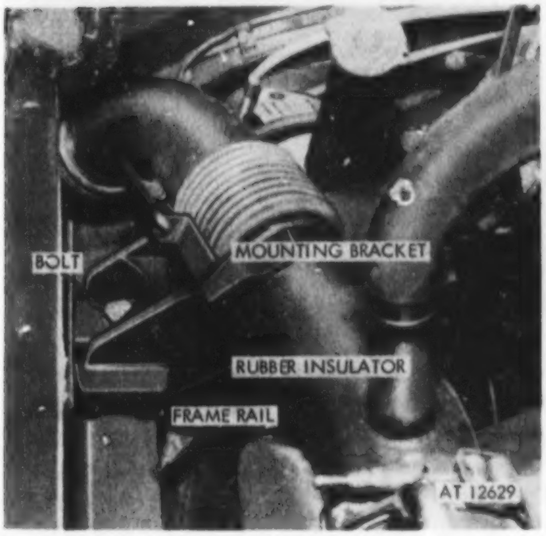

BOLT
MOUNTING BRACKET
RUBBER INSULATOR
FRAME RAIL
AT 12629

Figure 2–106. Engine rear mount, right side.

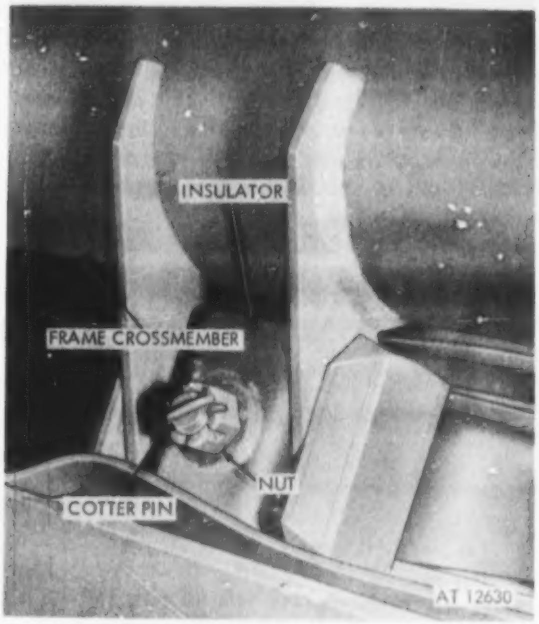

INSULATOR
FRAME CROSSMEMBER
NUT
COTTER PIN
AT 12630

Figure 2–107. Engine front mount.

(7) Disconnect transmission oil inlet and outlet lines at housing elbows (fig. 2–113). Plug lines and elbow fitting to prevent entry of foreign matter.

(8) Remove transmission housing mounting screw, lockwasher and clamp securing oil filler tube to transmission (fig. 2–112).

(9) Loosen adapter nut (fig. 2–113) and disconnect filler tube from transmission housing. Secure tube to side of engine.

(10) Remove six screws and six lockwashers securing access cover to flywheel housing (fig. 2–114). Remove cover and discard gasket.

(11) Position engine barring tool (11600-900) through access opening (fig. 2–115). Turn engine as required and remove six locking nuts securing transmission torque converted to engine flywheel.

(12) Attach lifting sling (7083778) to transmission housing (fig. 2–116), and using hoist support weight of transmission assembly.

(13) Remove remaining 11 mounting screws, lockwashers and flat washers securing transmission to engine (2–116).

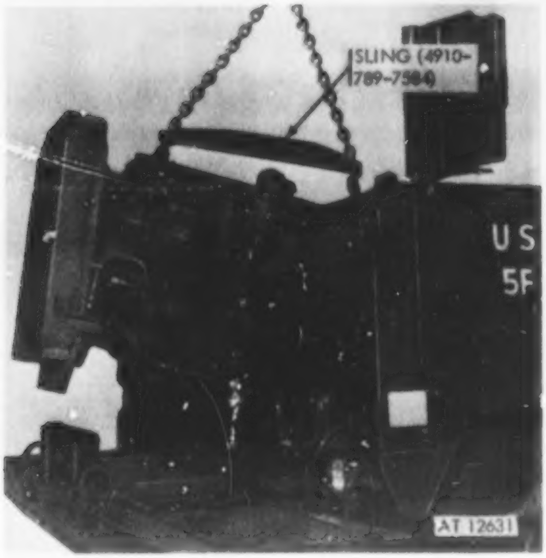


Figure 2–108. Removing power plant from vehicle.

(14 While supporting transmission with hoist (or floor jack), balance and pull rearward to separate transmission from engine assembly (fig. 2–117).

(15) Support transmission on blocking or stand.

(16) Discard transmission to engine gasket.

2–39. Transmission Installation

a. Refer to removal procedures (para 2–38) and reverse sequence to install transmission.

Caution: **When connecting the transmission to the engine, the six studs in the torque converter must aline with the six holes in the flywheel, and the converter pilot must fit into the center opening of the flywheel. Do not force entry of the studs.**

b. Torque Values.

Transmission housing to engine screws	**23–28 lb-ft**
Transmission torque converter to engine flywheel nuts	**34–40 lb-ft**

c. Lubrication. Refer to LO 9–2320–230–12 to service the transmission after installation.

d. Linkage Adjustment. Refer to paragraphs 2–131 and 2–132 for linkage adjustment.

2–40. Power Plant Installation

a. Preliminary Procedures.

(1) Check all parts and accessories for secure mounting or visual damage, giving particular attention to any accessory replaced after removal of the power plant from the vehicle. Make sure that adjustments and installation of parts and accessories have been completely accomplished.

(2) Attach lifting sling (4810–789–7584)

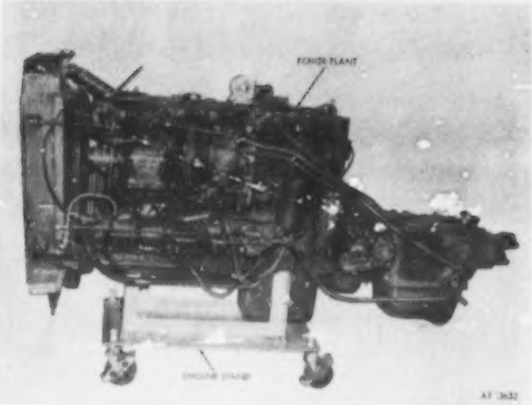

POWER PLANT
ENGINE STAND
AT 12632

Figure 2-109. Power plant on engine stand.

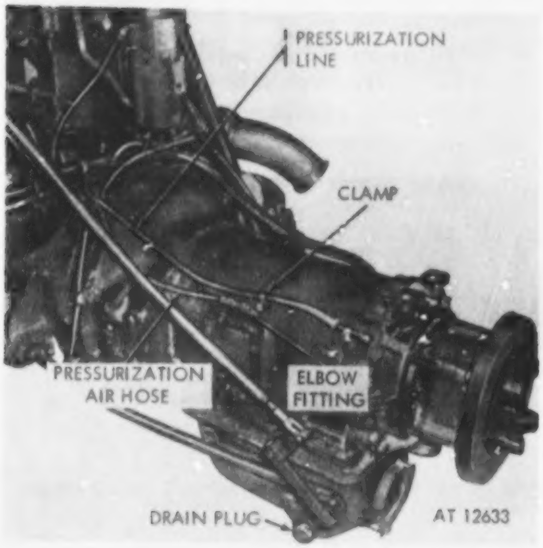

PRESSURIZATION LINE
CLAMP
PRESSURIZATION AIR HOSE
ELBOW FITTING
DRAIN PLUG
AT 12633

Figure 2-110. Transmission assembly, left side view.

to engine. Adjust sling so that front of power plant will tilt slightly upward when lifted.

(3) Lift power plant high enough to clear the front bumper and cab lower crossmember (and/or winch). Slowly move the power plant into the vehicle engine compartment. Check to make sure all lines and accessories of the power plant clear the bulkheads of the engine compartment. Continue to move power plant into vehicle, and at same time lower hoist until mounting brackets on each side of the flywheel housing are directly in line with the mounting holes in the frame side rails.

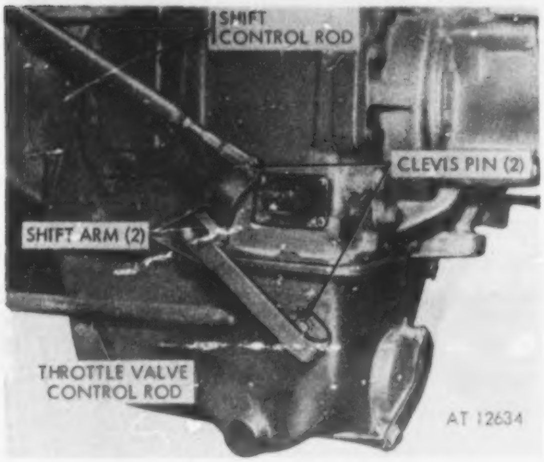

SHIFT CONTROL ROD
CLEVIS PIN (2)
SHIFT ARM (2)
THROTTLE VALVE CONTROL ROD
AT 12634

Figure 2-111. Transmission shift arms and control rods.

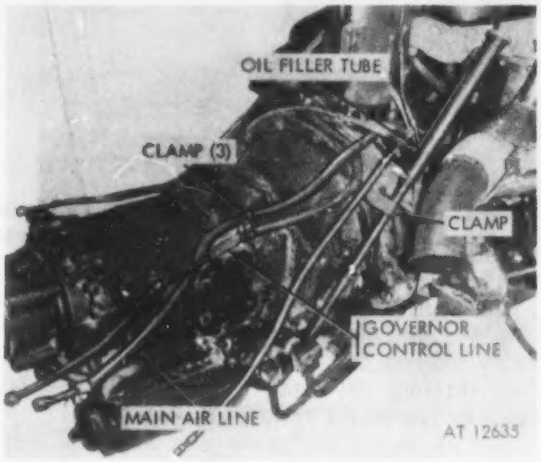

OIL FILLER TUBE
CLAMP (3)
CLAMP
GOVERNOR CONTROL LINE
MAIN AIR LINE
AT 12635

Figure 2-112. Transmission assembly, right side view.

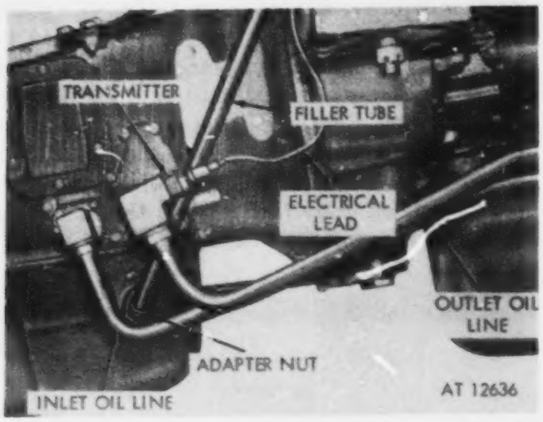

TRANSMITTER
FILLER TUBE
ELECTRICAL LEAD
OUTLET OIL LINE
ADAPTER NUT
INLET OIL LINE
AT 12636

Figure 2-113. Transmission oil inlet and outlet housing.

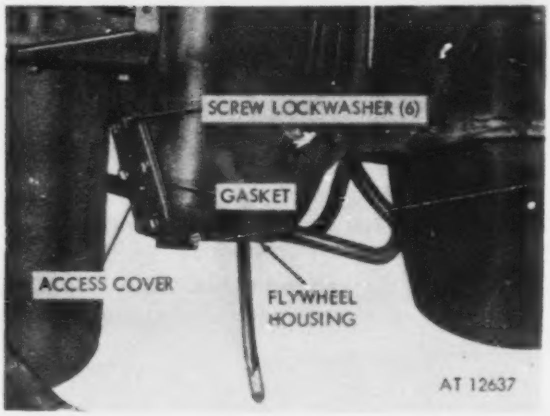

SCREW LOCKWASHER (6)
GASKET
ACCESS COVER
FLYWHEEL HOUSING
AT 12637

Figure 2-114. Flywheel access cover.

(4) Position the two rear mounting pads and spacers on the rear mounting brackets. Lower power plant slowly until the rear bracket mounting pads rest on the frame side rails, and at the same time guide the front engine support bolt with mounting pad and spacer through the front mounting bracket bolt hole of the frame front crossmember.

Note. Do not rest power plant solidly on engine mounts until rear mounting pads, spacers and insulators have been positioned on the brackets and the mounting bolt holes aline.

b. Connecting Procedures Under Power Plant.

(1) Lower power plant and secure rear mounts using bolt, nut, and cotter pin (fig. 2-106).

(2) Secure front engine mount using rubber insulator, nut and cotter pin (fig. 2-107).

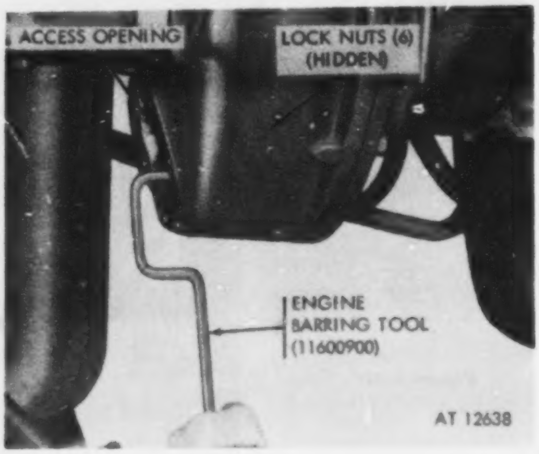

ACCESS OPENING
LOCK NUTS (6) (HIDDEN)
ENGINE BARRING TOOL (11600900)
AT 12638

Figure 2-115. Using engine barring tool (11600900) to turn engine.

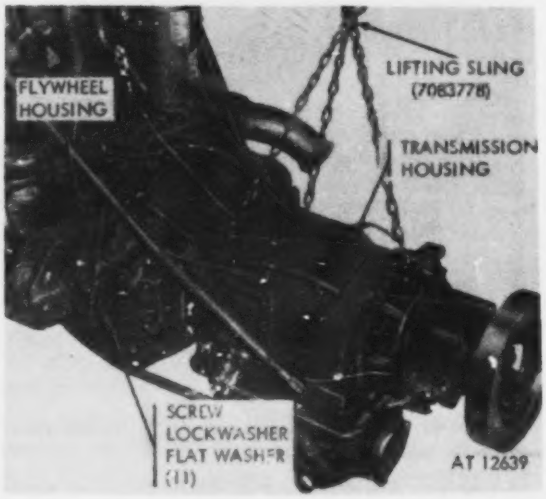

FLYWHEEL HOUSING
LIFTING SLING (7083778)
TRANSMISSION HOUSING
SCREW LOCKWASHER FLAT WASHER (11)
AT 12639

Figure 2-116. Sling (7083778) attached to transmission housing.

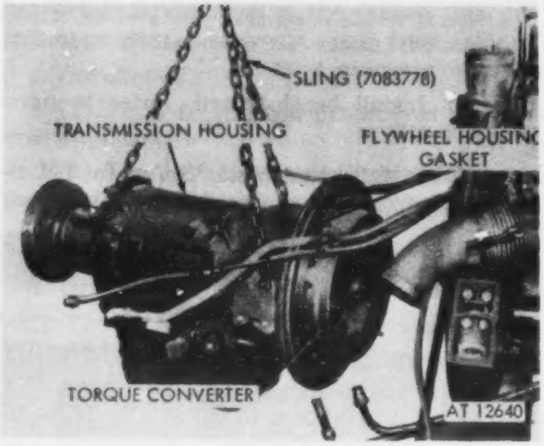


Figure 2-117. Transmission separated from engine assembly.

(3) Remove lifting sling (4910-789-7584) from engine.

(4) Position main drive propeller shaft front universal joint assembly to drive flange of transmission, and secure with two bearing caps and four self-locking bolts (fig. 2-104).

(5) Connect air governor unload line to air hose connected to air governor (fig. 2-101).

(6) Connect shielded air hose to air compressor main air line and secure with clamp to the upper right side of the transmission (fig. 2-101).

(7) Connect engine air pressurization hose to fitting on air manifold at right rear of cab (fig. 2-102).

(8) Position front-intermediate exhaust pipe and new gasket to engine front exhaust pipe (fig. 2-100) and secure with pipe clamp.

(9) Secure engine starter ground cable (fig. 2-98) to right frame rail of vehicle with bolt, external tooth washer, and nut.

(10) Connect wiring harness to receptacle of starter relay (fig. 2-99) mounted on inner side of frame rail right side.

c. Connecting Procedures at Left Side of Engine.

(1) Connect power steering reservoir return hose (fig. 2-96) to fitting on frame left side rail.

(2) Connect air pressurization hose to air line secured to left side of transmission (fig. 2-103).

(3) Connect power steering oil pressure line to extension line elbow fitting (fig. 2-95).

(4) Connect fuel inlet and fuel return hoses to fittings on fuel manifold on frame left side rail (fig. 2-97).

(5) Position and secure engine accelerator rod to accelerator control arm with bolt, lockwasher and nut (fig. 2-94). Refer to paragraph 2-57 for rod adjustment.

(6) Connect tachometer cable assembly to cable adapter on forward upper end of left bulkhead.

d. Connecting Procedures at Right Side of Engine.

(1) Position turbocharger air intake elbow to fitting on right bulkhead and secure with clamp (fig. 2-93).

(2) Position air compressor intake hose to fitting on right bulkhead and secure with clamp (fig. 2-93).

(3) Position three electrical cable connectors to respective receptacles on right bulkhead and secure connectors (fig. 2-93).

e. Procedures Before Starting Engine.

(1) Make sure all air reservoir and fue drain cocks are closed.

(2) Fill power steering oil reservoir. R fer to LO 9-2320-230-12.

(3) Check engine oil, transmission lubricant and coolant levels; refill as necessary. Refer to LO 9-2320-230-12.

(4) Check all installed lines, hoses, and wiring harnesses for tightness and proper installation.

(5) Connect battery ground cable to negative post of battery (fig. 2-89).

f. Procedures After Starting Engine.

(1) Start engine (refer to TM

9-2320-230-10). After engine is running, make a complete inspection of the power plant for fuel, coolant, air and oil leaks. Repair any leaks immediately.

(2) Raise front of vehicle to remove weight from two front axles. Turn steering wheel in both directions to bleed steering oil system. Replenish oil in steering system reservoir after bleeding. Refer to LO 9-2320-230-12.

g. Final Procedures.

(1) After satisfactory operation of the engine has been achieved and no leaks are present, install the cab front crossmember. Refer to paragraph 2-76.

(2) Install engine front and rear hatch covers (fig. 2-92).

(3) Install gear selector knob and shift position pointer (fig. 2-92).

Note. If vehicle is equipped with a winch, connect the winch drive shaft to the winch gearbox input shaft. Refer to paragraph 2-262.

(4) Install brush guard. Refer to paragraph 2-210.

(5) Install windshield. Refer to TM 9-2320-230-10.

(6) Install cab soft top. Refer to TM 9-2320-230-10.

h. Torque Valves.

Rear engine mount nuts	90-100 lb-ft
Front engine mount nuts	90-100 lb-ft
Main propeller shaft universal bolts	90-100 lb-ft

Section XI. SERVICE INSTRUCTIONS FOR ENGINE MOUNTS, CRANKCASE BREATHER AND OIL FILTERS

2-41. General

This section contains procedures for removal and installation of engine front and rear mounts, engine crankcase breather and engine oil filter elements.

2-42. Engine Rear Mount

a. Description. The two engine rear mounts consist of upper and lower insulators, spacers, bolt, nut and cotter pin are secured to the right and left sides of the engine flywheel housing and support the rear of the power plant (fig. 2-118).

b. Removal.

(1) Place a jack with wooden block under the flywheel housing to support the rear of the engine and transmission housing.

(2) Remove two cotter pins and nuts securing right and left mount bolts to right and left frame side rails.

(3) Jack up rear of power plant until weight is removed from frame side rails.

(4) Remove mount bolt, upper and lower insulator and spacer (fig. 2-119).

Note. If mounting bracket (fig. 2-119) is broken or damaged, it may be removed by removing four bolts and lockwashers securing bracket to flywheel housing.

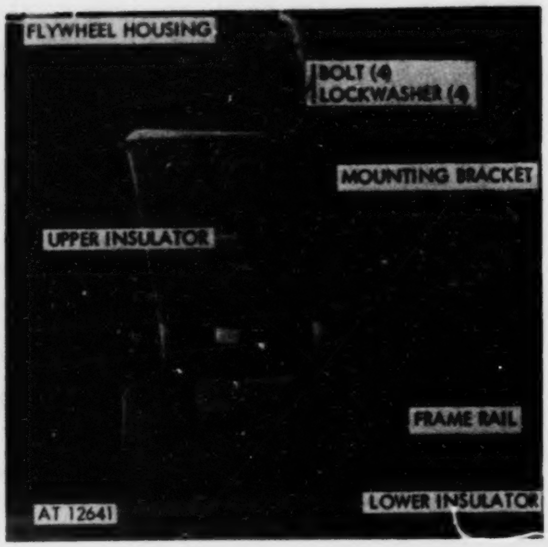


Figure 2-118. Left rear engine mount.

***Warning:* Never remove both rear mounting brackets at one time. Always replace one bracket before removing the other; this procedure prevents the power plant from falling.**

c. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Tighten mounting bolt nuts to 90–100 lb-ft. before installing new cotter pins.

2–43. Engine Front Mount

a. Description. The engine front mount consists of upper and lower insulators, spacer, nut, bolt and cotter pin.

b. Removal.

(1) Remove radiator brush guard, refer to paragraph 2–210.

(2) Remove engine front and rear hatch covers, refer to paragraph 2–37.

(3) Remove upper cab crossmember, refer to paragraph 2–76.

(4) Loosen front exhaust pipe clamp from intermediate exhaust pipe assembly (fig. 2–100) and slide clamp on intermediate exhaust pipe.

(5) Loosen two clamps securing turbocharger elbow and air compressor air inlet hose

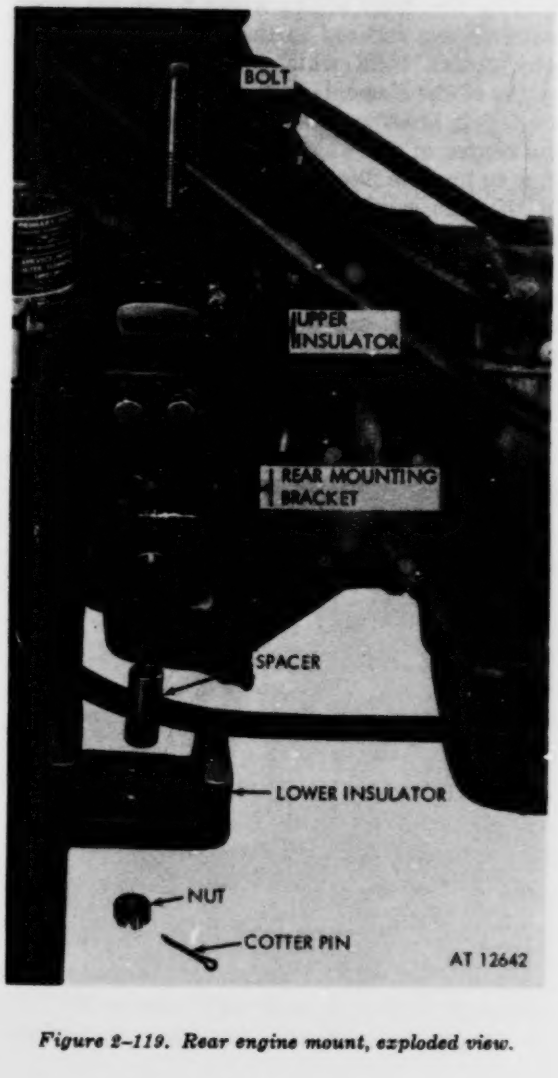

BOLT
UPPER INSULATOR
REAR MOUNTING BRACKET
SPACER
LOWER INSULATOR
NUT
COTTER PIN
AT 12642

Figure 2–119. Rear engine mount, exploded view.

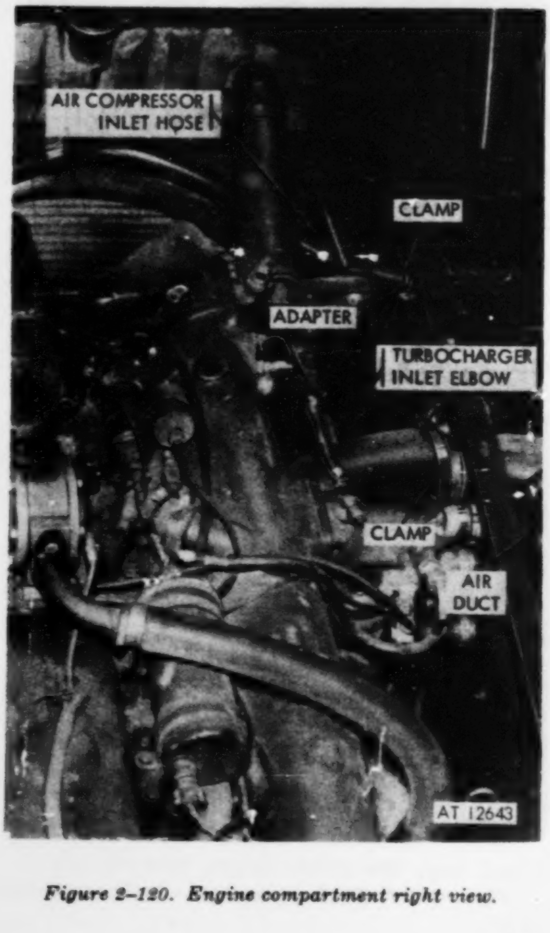

AIR COMPRESSOR INLET HOSE
CLAMP
ADAPTER
TURBOCHARGER INLET ELBOW
CLAMP
AIR DUCT
AT 12643

Figure 2–120. Engine compartment right view.

at left bulkhead (fig. 2-120). Disconnect hoses from adapter and air duct.

(6) Remove nut, lockwasher and bolt securing accelerator rod to accelerator control arm (fig. 2-94).

Note. When vehicle is equipped with winch, the drive shaft must be disconnected from the winch and tied to upper front of bulkhead.

(7) Remove two cotter pins and nuts securing right and left rear engine mounts to side rails of vehicle frame (fig. 2-118).

(8) Place jack and wood block under engine flywheel housing; raise engine until left and right rear mounts can be removed.

(9) Place drift pins through engine support bracket and mating holes in vehicle frame.

Note. Drift pins will keep rear mounts in alinement and allow the front of the engine to be raised without binding on the rear mounts.

(10) Remove cotter pin, nut and lower insulator from front mount bolt (fig. 2-121).

Note. Bolt remains captive to engine and radiator support assembly.

(11) Use jack to carefully raise engine until upper insulator and spacer can be removed from mounting bolt (fig. 2-122).

c. *Installation.*

(1) Refer to removal procedures and reverse sequence.

(2) Tighten mount bolt nuts to 90-100 lb-ft after removing jack from under engine and before installing new cotter pins.

2-44. Engine Lubrication System

A schematic drawing of the lubrication system is shown in figure 2-123. Filtration of the lubricating oil is accomplished by two replaceable element-type filters. A coolant-jacketed oil cooler is provided to maintain the lubricating oil temperatures at an acceptable level during normal operation. Two engine oil filters are mounted on the left side of the engine (fig. 2-126). The filter bodies which house the filter elements are secured to the filter base by two long center bolts which extend through the center of the elements into the base. An engine crankcase breather assembly is mounted to the top center of the engine which allows the engine to breathe filtered air through an air filter in the left cover. The opposite cover of the breather housing supports a fitting for pressurization of the engine during swimming operation. Pressurized gases from the engine crankcase are expelled through the engine breather and connecting hose assembly into the engine exhaust system.

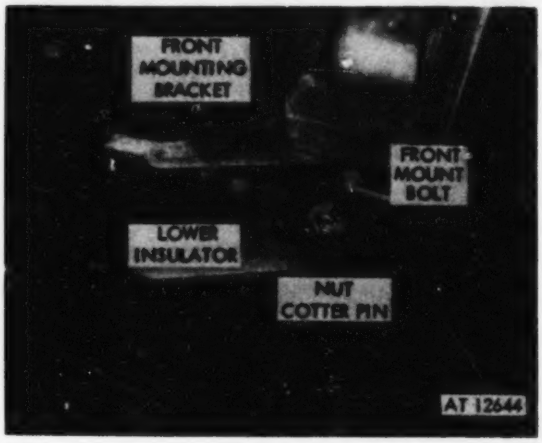


Figure 2-121. Engine front mount, bottom view.

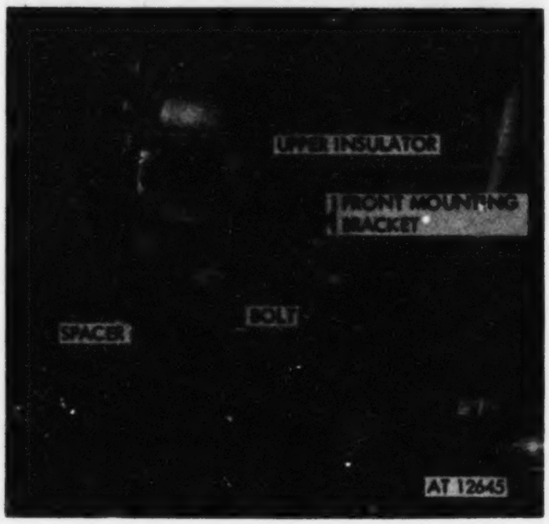


Figure 2-122. Upper insulator and spacer.

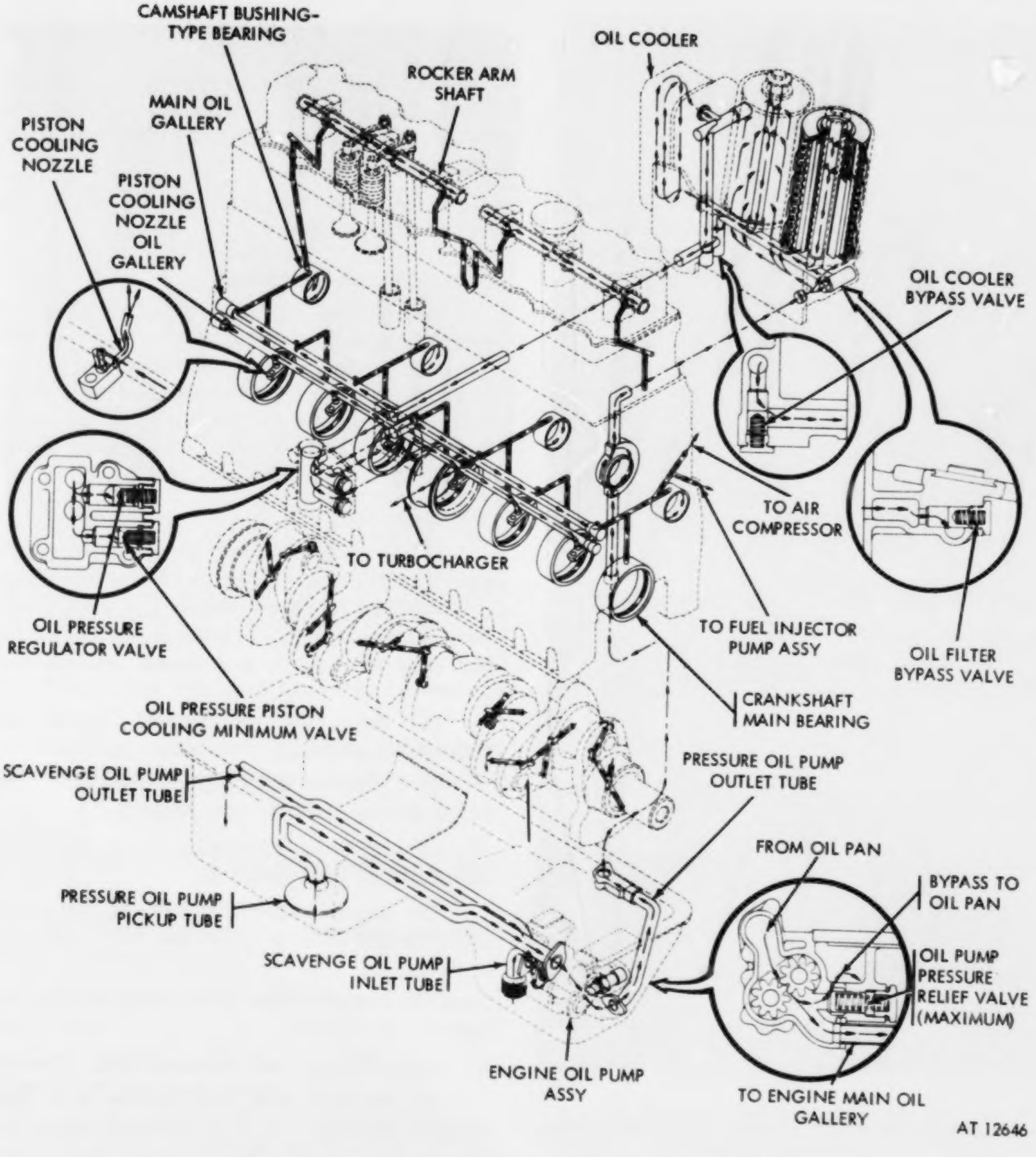

CAMSHAFT BUSHING-TYPE BEARING
OIL COOLER
ROCKER ARM SHAFT
MAIN OIL GALLERY
PISTON COOLING NOZZLE
PISTON COOLING NOZZLE OIL GALLERY
OIL COOLER BYPASS VALVE
TO AIR COMPRESSOR
TO TURBOCHARGER
OIL PRESSURE REGULATOR VALVE
TO FUEL INJECTOR PUMP ASSY
OIL FILTER BYPASS VALVE
CRANKSHAFT MAIN BEARING
OIL PRESSURE PISTON COOLING MINIMUM VALVE
SCAVENGE OIL PUMP OUTLET TUBE
PRESSURE OIL PUMP OUTLET TUBE
FROM OIL PAN
BYPASS TO OIL PAN
PRESSURE OIL PUMP PICKUP TUBE
OIL PUMP PRESSURE RELIEF VALVE (MAXIMUM)
SCAVENGE OIL PUMP INLET TUBE
ENGINE OIL PUMP ASSY
TO ENGINE MAIN OIL GALLERY
AT 12646

Figure 2-123. Engine lubricating system, schematic drawing.

2-45. Crankcase Breather

a. Service. The air filter (fig. 2-124) of the breather assembly should be serviced at each "S" PM service. The filter should be removed, washed in approved dry-cleaning solvent or mineral spirits paint thinner, and dried with compressed air.

b. Removal of Breather Assembly.

(1) Remove engine front and rear hatch covers. Refer to paragraph 2-37.

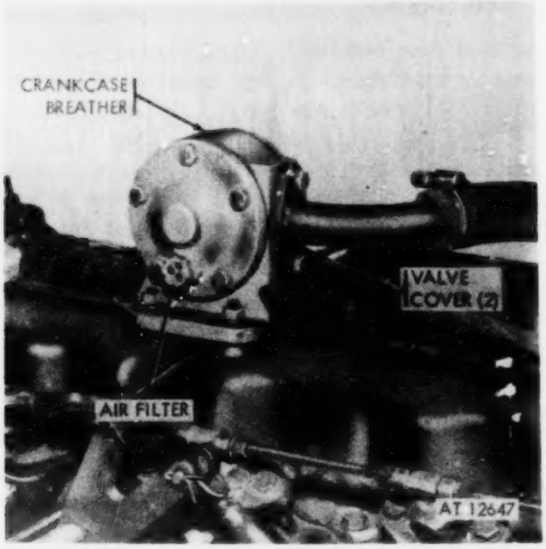


Figure 2-124. Engine crankcase breather and air filter.

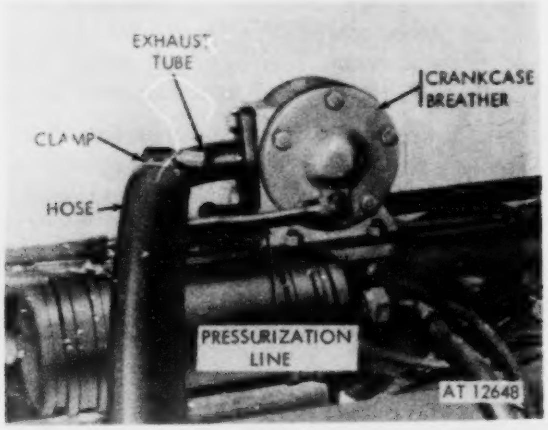


Figure 2-125. Engine breather exhaust tube and pressurization line.

(2) Disconnect pressurization line from fitting on breather housing (fig. 2-125).

(3) Loosen clamps and remove exhaust hose from exhaust tube pipe adapter on breather housing and turbocharger (fig. 2-125).

(4) Remove four nuts and lockwashers securing breather assembly to tappet covers (fig. 2-125) and remove assembly.

(5) Clean parts with dry-cleaning solvent. Clean carbon from turbocharger exhaust pipe fitting with small wire brush or probe and solvent.

c. Installation. Refer to removal procedures and reverse sequence.

2-46. Engine Oil Filters

a. Service. The engine oil and filter elements should be changed every 3000 miles of vehicle operation under normal operation conditions. Refer to LO 9-2320-230-12. However, under abnormal operating conditions, or unusually dusty terrain, it is necessary to change engine oil and filter elements more frequently.

b. Removal.

(1) Drain the engine oil in a container by removing the drain plugs from the two sump basins of the oil pan.

Note. Drain the engine oil immediately after engine shut down while the oil is at normal operating temperature.

(2) After oil has drained, install and tighten the oil pan drain plugs.

(3) Remove the engine front and rear hatch covers. Refer to paragraph 2-37.

(4) Remove drain plug from filter base and drain oil into container.

(5) Remove the center bolt and bolt gasket securing the filter body to the filter base (fig. 2-126).

(6) Remove filter body and compression spring (fig. 2-127).

(7) Remove and discard filter element.

(8) Remove filter body gasket from base. Discard gasket.

***Caution:* When removing oil filter bodies and elements, extra care must be taken to insure that no dirt or sludge falls on the filter base or gets in the base opening.**

c. Cleaning.

(1) Wipe base clean with lint-free cloth.

(2) Clean filter body and center bolt with

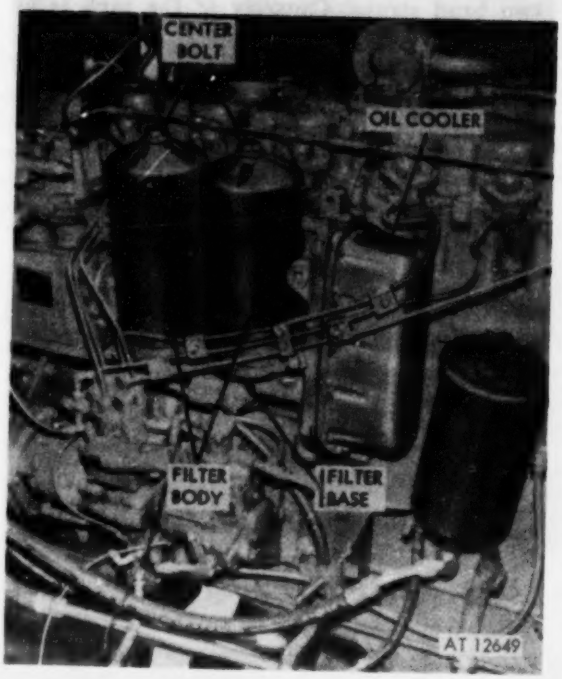


Figure 2-126. Engine oil filters and oil cooler.

dry-cleaning solvent or mineral spirits paint thinner. Wipe dry with clean, lint-free cloth.

d. Installation.

(1) Place new filter body gasket on filter base.

(2) Place new filter element and filter body on filter base.

(3) Use new center bolt gasket to install center bolt.

Note. Hold filter body while tightening center bolt to prevent cutting base gasket.

e. Final Procedures.

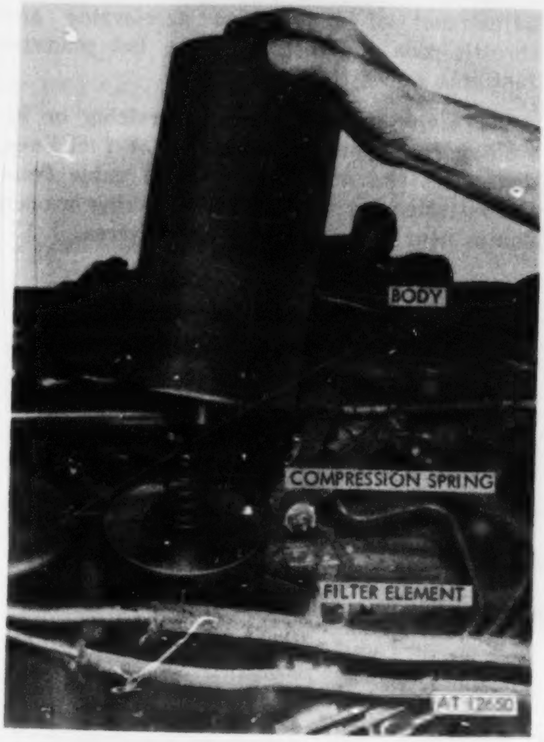


Figure 2-127. Oil filter compression spring.

(1) Replenish the engine crankcase with oil. Refer to LO 9-2320-230-12.

(2) Start the engine and operate it at 1000 to 1200 rpm with the transmission in neutral until the engine has reached operating temperature. Check oil pressure gage for normal reading (30-45 lbs) and the filter base, filter bodies and engine drain plugs for signs of oil leakage.

(3) Stop engine and check engine oil level, add oil as necessary.

(4) Replace engine hatch covers (fig. 2-92).

Section XII. VEHICLE FUEL SYSTEM

2-47. General

This section provides removal and installation instructions and service procedures where necessary for the fuel system components of the M656 cargo truck (fig. 2-128), the XM 791 expansible van (fig. 2-129) and the XM757 tractor truck (fig. 2-130). It also provides instructions on service, replacement, repair and adjustment of the engine accelerator and throttle rods and their linkages, low pressure fuel lines and fittings.

Warning: **When removing, servicing or installing fuel system components or fuel lines, disconnect the negative (ground) cable from the batteries and do not permit smoking or open flames near the vehicle or service area.**

2-48. Fuel Tank

a. Description.

(1) *M656 cargo truck and XM791 expansible van.* These vehicles have one fuel tank that is mounted to the frame left side rail of the vehicle (fig. 2-131). The tank is secured by two band straps. Capacity of the tank is approximately 80 gallons.

(2) *XM757 tractor truck.* The XM757 tractor truck has two fuel tanks identical to the fuel tank mounted on the M656 cargo truck. The tanks are mounted in the same manner to the frame left side rail and the frame right side rail. Fuel from either tank may be selected by the driver.

b. Removal.

(1) *Loosen fuel tank cap.* Removal tank drain plug (fig. 2-131) and drain fuel into suitable container.

Note. Fuel tank capacity is approximately 80 gallons.

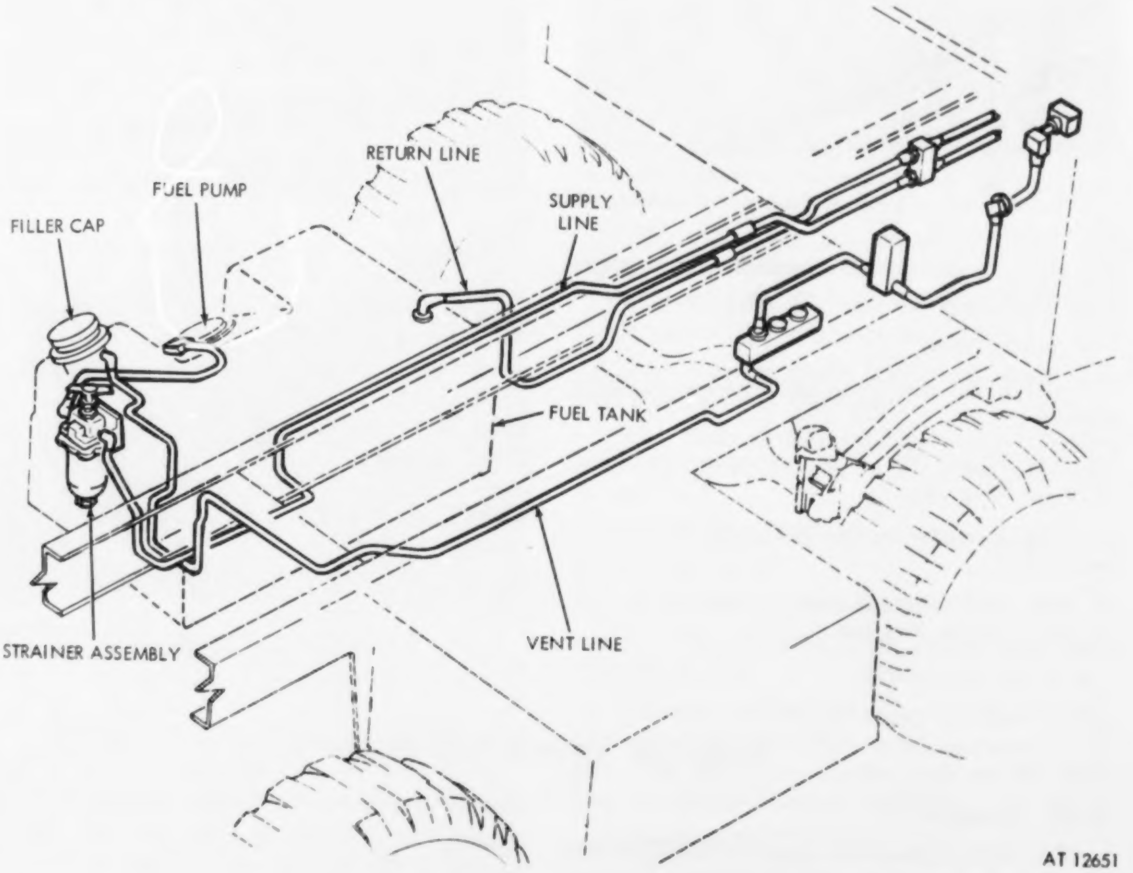


Figure 2-128. Fuel system diagram, M656 cargo truck.

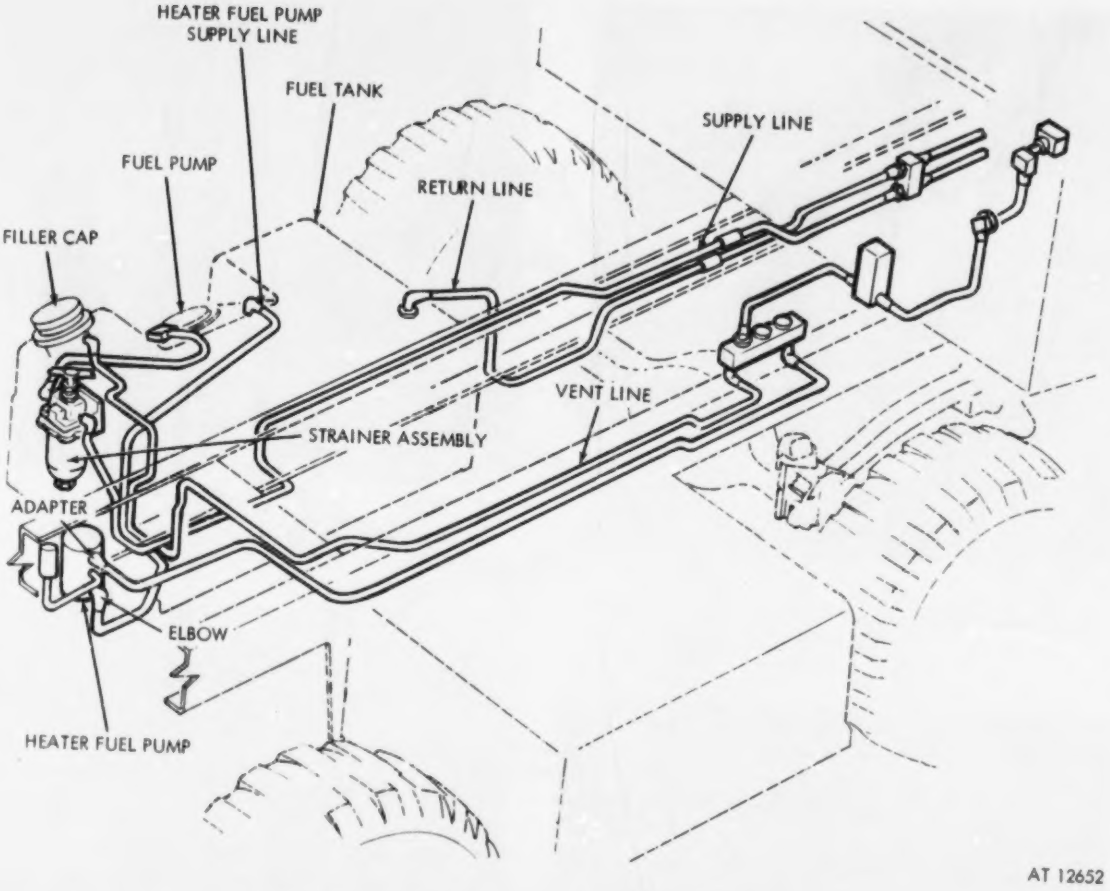

HEATER FUEL PUMP SUPPLY LINE
FUEL TANK
SUPPLY LINE
FUEL PUMP
RETURN LINE
FILLER CAP
VENT LINE
STRAINER ASSEMBLY
ADAPTER
ELBOW
HEATER FUEL PUMP
AT 12652

Figure 2-129. Fuel system diagram, XM791 expansible van.

(2) Tighten fuel tank cap and install drain plug with copper clad gasket.

(3) Disconnect fuel tank vent line from fitting on fuel tank filler neck (fig. 2-132).

(4) Remove nut, lockwasher and flat washer securing ground wire to filler neck flange (fig. 2-132).

(5) Remove screw and lockwasher and disconnect ground wire from fuel level transmitter (fig. 2-133).

(6) Disconnect electrical lead at connector on fuel level transmitter (fig. 2-133).

(7) Disconnect electrical lead and ground wire at connector on fuel tank electrical pump assembly (fig. 2-134).

(8) Disconnect fuel outlet line from fitting on fuel pump assembly (fig. 2-134).

(9) Disconnect fuel outlet line from fuel strainer and remove line.

(10) Disconnect fuel return line from fitting on top side of fuel tank (fig. 2-135).

(11) Disconnect van heater fuel line from elbow fitting on top side of fuel tank (fig. 2-133) XM791 vehicles only.

(12) Remove two nuts, and flat washers securing fuel tank retaining straps to tank support (fig. 2-131).

(13) Raise retaining straps and slide tank outward from support. Remove tank.

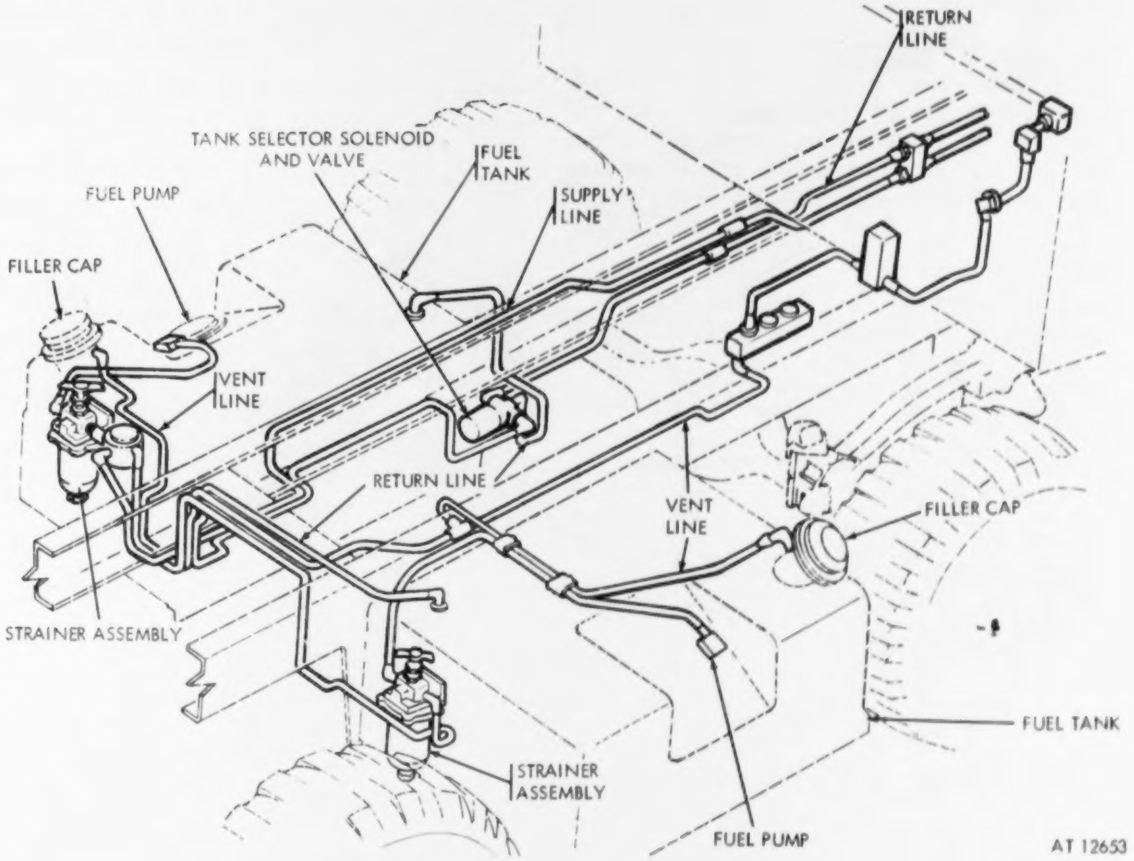

RETURN LINE
TANK SELECTOR SOLENOID AND VALVE
FUEL TANK
FUEL PUMP
SUPPLY LINE
FILLER CAP
VENT LINE
RETURN LINE
VENT LINE
FILLER CAP
STRAINER ASSEMBLY
FUEL TANK
STRAINER ASSEMBLY
FUEL PUMP
AT 12653

Figure 2–130. Fuel system diagram, XM757 tractor truck.

c. Installation. Refer to removal procedures and reverse sequence to install fuel tank.

Note. When installing fuel tank make sure the insulating straps and retaining straps are in satisfactory condition and properly placed.

2–49. Fuel Tank Pump Fuse

a. Description. A 2–ampere-automotive-type fuse is used to protect the fuel pump from short circuits. The fuse and fuse holder are encased in the fuel pump terminal cover mounted to the fuel pump mounting plate.

b. Removal.

(1) Disconnect fuel pump electrical lead and ground wire at electrical terminal connector (fig. 2–134).

(2) Straighten seal retainer tab and remove seal (fig. 2–134). Discard seal.

(3) Remove three nuts and lockwashers securing terminal cover to pump mounting plate (fig. 2–134).

(4) Lift terminal cover from mounting studs.

(5) Remove fuse from fuse holder (fig. 2–136).

c. Installation. Refer to removal procedures and reverse sequence using new cover gasket and seal.

2–50. Fuel Tank Electrical Pump

a. Description. An electrical fuel pump is installed in the vehicle fuel tank to supply fuel

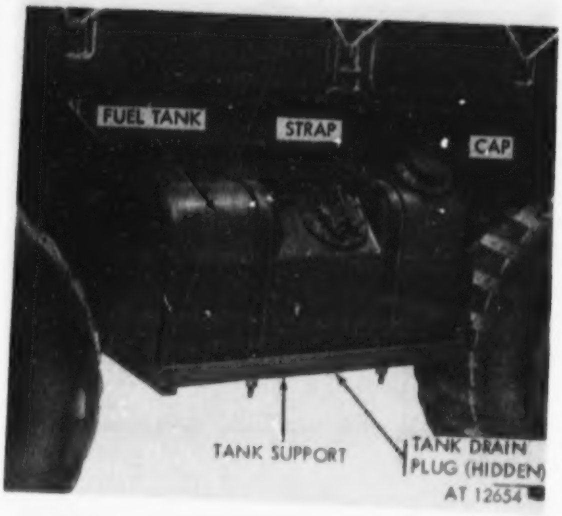

FUEL TANK
STRAP
CAP
TANK SUPPORT
TANK DRAIN PLUG (HIDDEN)
AT 12654

Figure 2-131. Fuel tank, M656 cargo truck.

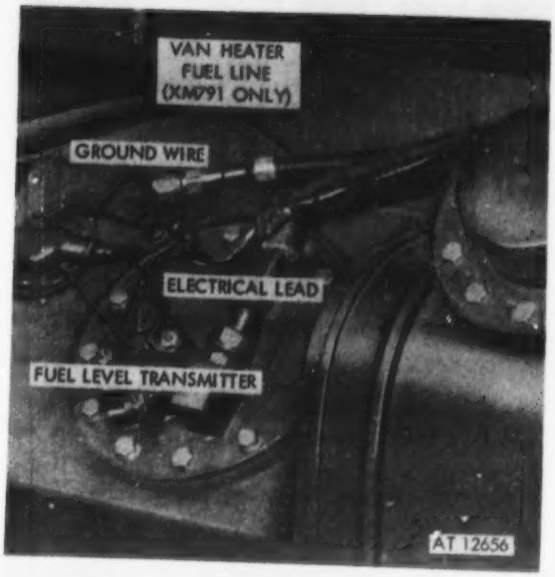

VAN HEATER FUEL LINE (XM791 ONLY)
GROUND WIRE
ELECTRICAL LEAD
FUEL LEVEL TRANSMITTER
AT 12656

Figure 2-133. XM791 van heater fuel line, installed view.

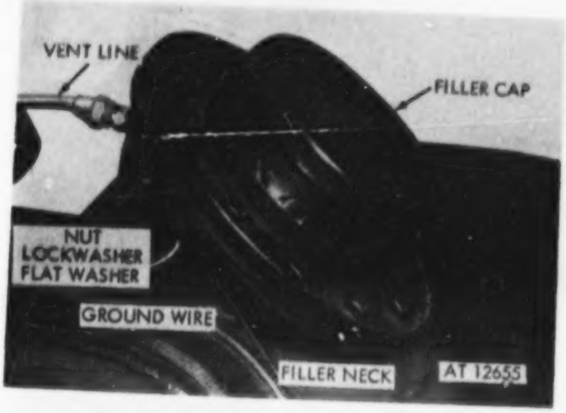

VENT LINE
FILLER CAP
NUT
LOCKWASHER
FLAT WASHER
GROUND WIRE
FILLER NECK
AT 12655

Figure 2-132. Fuel tank vent line and ground wire.

for engine operation. The cover plate of the fuel pump assembly is secured to the fuel tank with 12 capscrews and lockwashers.

b. Removal (Fig. 2-137).

(1) Disconnect electrical lead and ground wire at connector on terminal cover (fig. 2-134).

(2) Disconnect fuel outlet line from pump assembly (fig. 2-134).

(3) Remove 12 screws and lockwashers se-

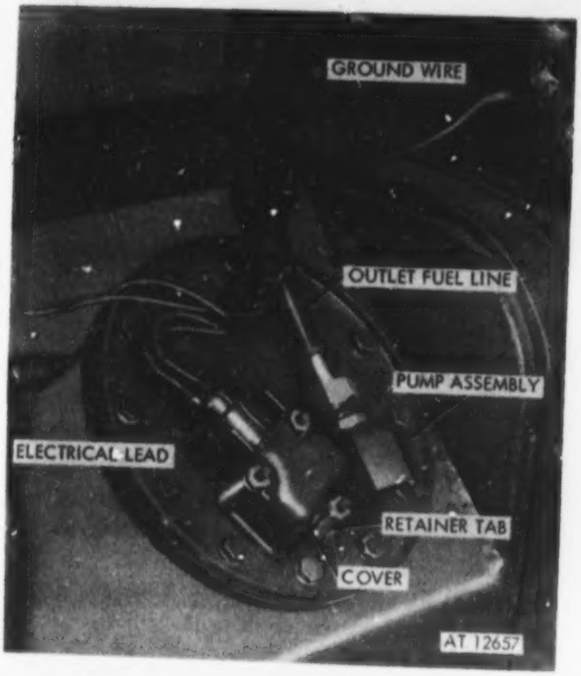

GROUND WIRE
OUTLET FUEL LINE
PUMP ASSEMBLY
ELECTRICAL LEAD
RETAINER TAB
COVER
AT 12657

Figure 2-134. Fuel tank electrical pump assembly.

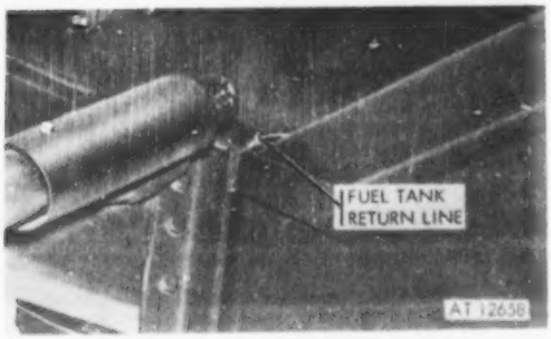

FUEL TANK
RETURN LINE
AT 12658

Figure 2-135. Fuel tank return line.

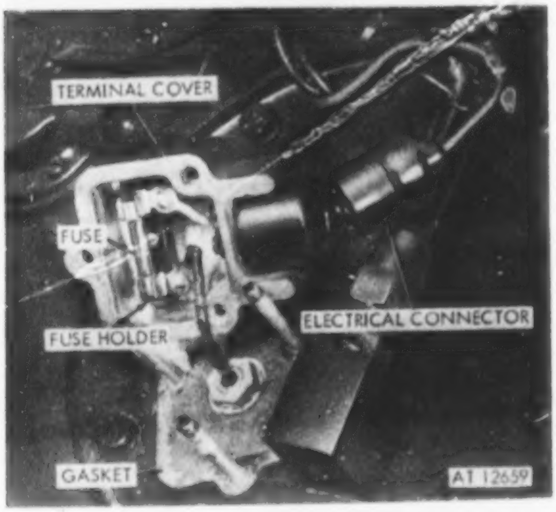

TERMINAL COVER
FUSE
FUSE HOLDER
ELECTRICAL CONNECTOR
GASKET
AT 12659

Figure 2-136. Fuel pump terminal cover and fuse.

curing pump assembly mounting plate to fuel tank.

(4) Remove electrical fuel pump assembly from fuel tank and discard gasket.

c. *Installation.* After installing a new fuel pump hanger grommet and gasket, proerly position the pump assembly on support pin located inside bottom of fuel tank, secure pump.

Note. Tighten mounting screw to 17-19 lb-ft.

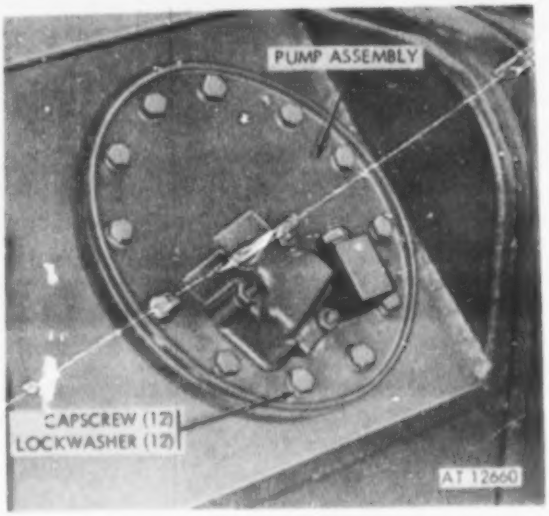

PUMP ASSEMBLY
CAPSCREW (12)
LOCKWASHER (12)
AT 12660

Figure 2-137. Removal or installation of fuel tank fuel pump assembly.

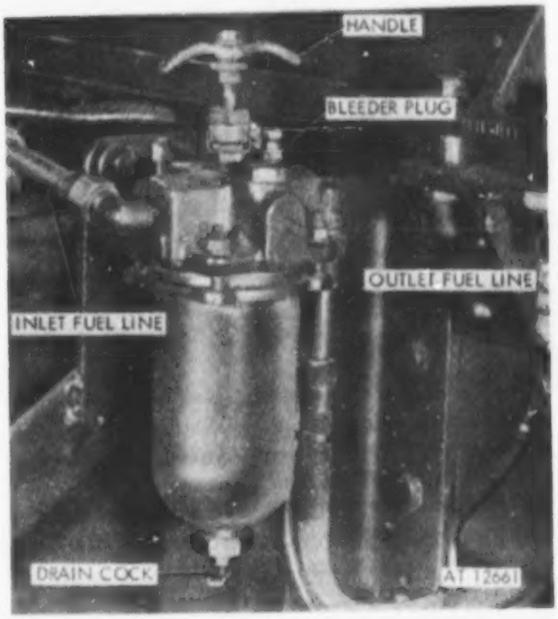

HANDLE
BLEEDER PLUG
OUTLET FUEL LINE
INLET FUEL LINE
DRAIN COCK
AT 12661

Figure 2-138. Primary fuel strainer, installed view.

2-51. Primary Fuel Strainer

a. *Description.* The primary fuel strainer is a spaced bronze ribbon wound cylinder having a manually controlled wiper blade which forces the sediment through the bronze ribbon causing it to settle in the bottom of the housing where it can be removed by opening the drain cock. The fuel strainer (fig. 2-138) is mounted to a welded bracket attached to the upper rear of the fuel tank support.

b. Service.

(1) Turn handle two complete revolutions.

Warning: **When removing, servicing or installing fuel strainer do not permit smoking or open flame near the vehicle. Observe all safety precautions.**

(2) Remove bleeder plug and open drain cock (fig. 2-138). Drain fuel from strainer housing.

Note. If large quantities of water or impurities are found when the strainer is drained, the secondary and final filters must be checked for water and impurities.

(3) Start engine and bleed air from strainer housing by unscrewing bleeder plug and letting trapped air in housing escape. When all air in the housing has escaped, tighten plug.

c. Removal (Fig. 2-138).

(1) Open strainer drain cock and drain fuel from strainer housing. Close drain cock.

(2) Disconnect inlet and outlet fuel lines from fittings on strainer base.

(3) Remove two nuts, lockwashers, and bolts securing strainer base to bracket. Remove strainer assembly.

d. Installation. Refer to removal procedures and reverse sequence of instructions.

Note. Strainer housing must be bled of air. Refer to *b* above.

2-52. Secondary Fuel Filter

a. Description. The secondary fuel filter is mounted in a clamp attached to the left rear side of the engine cylinder block (fig. 2-139). The filter receives the fuel after it has passed through the engine fuel pump, a component part of the fuel injector assembly. Fuel from the secondary fuel filter flows to the final fuel filter then back to the engine fuel injector. The secondary fuel filter has a replaceable filter element that must be changed every 3000 miles of vehicle operation or 3 months, whichever occurs first (see LC 9-2320-230-12). Also, the filter must be serviced and/or element replaced when water or sediment is found during draining operations.

b. Fuel Pressure Test.

(1) Connect pressure gage (0-300 psi) (FSN 6620-795-0330) to the final filter vent (fig. 2-140) and start the engine.

(2) Fuel pressure should be 65-75 psi at 1200 rpm. If pressure is lower than 65 psi at 1200 rpm, replace the filter elements.

c. Filter Element Replacement. To replace the secondary fuel filter element, proceed as follows.

(1) Remove engine rear hatch cover (para 2-36).

(2) Open filter vent valve and drain cock (fig. 2-139). Drain fuel into a container.

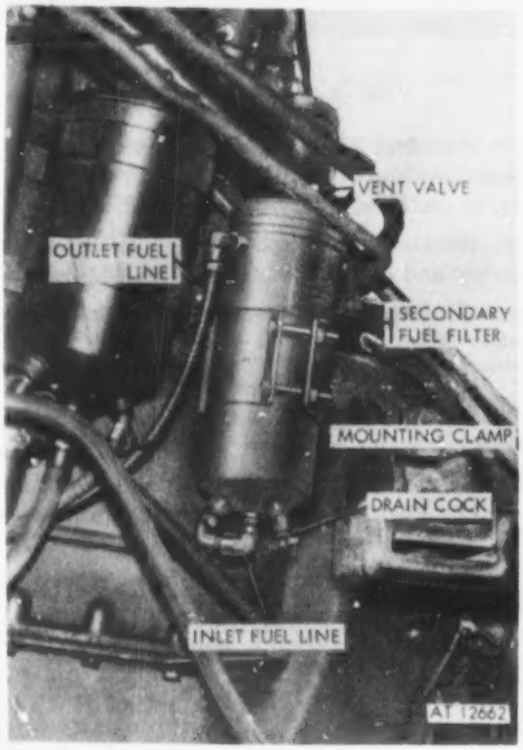


Figure 2-139. Secondary fuel filter lines and drain cock.

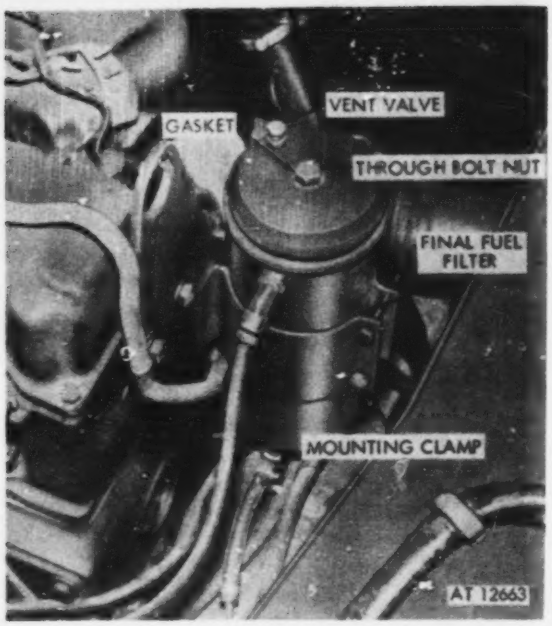


Figure 2-140. Final fuel filter.

Warning: **Do not permit smoking or open flame near the vehicle during removing, servicing, or installing fuel filter elements.**

(3) Loosen through bolt nut. Remove nut, washer and gasket securing cover (fig. 2-140).

(4) Remove housing cover and gasket (fig. 2-14).

(5) Remove filter element (fig. 2-141).

(6) Clean filter housing with solvent. Blow parts dry with low pressure dry air, or wipe with clean, lint-free cloth.

(7) Position new filter element in housing (fig. 2-141).

(8) Position cover and new gasket on housing (fig.2-141).

(9) Install through bolt nut using new gasket (fig. 2-140).

(10) Tighten through bolt nut to 85-95 lb-in.

(11) Close filter drain cock (fig. 2-139).

(12) Trun master switch to ON position and bleed air from filter housing.

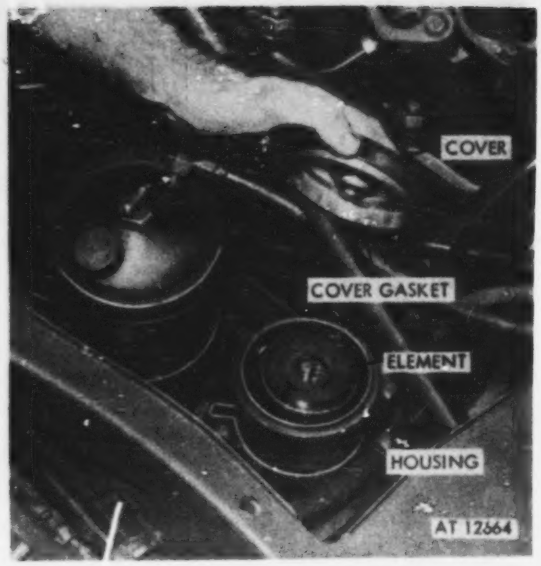


Figure 2-141. Secondary fuel filter, housing and element.

(13) Close drain valve and turn master switch to OFF position.

(14) Install engine rear hatch cover (fig. 2-92).

d. Filter Replacement.

(1) Remove engine rear hatch cover (para 2-36).

(2) Open filter vent valve and drain cock (fig. 2-139). Drain fuel into suitable container.

Warning: **Do not permit smoking or open flames near the vehicle during removing, servicing, or installing fuel filter elements.**

(3) Disconnect fuel inlet and outlet hoses from filter housing (fig. 2-139).

(4) Loosen two nuts securing housing clamp bolts (fig. 2-139). Remove filter assembly from clamp.

(5) To install secondary fuel filter, reverse procedures (2) through (4) above.

(6) Refer to *c* above and bleed air from filter housing.

(7) Install engine rear hatch cover (fig. 2-92).

2–53. Final Fuel Filter

a. General. The final fuel filter is mounted by a clamp bracket attached to the rear of the engine (fig. 2–140). The element must be changed every 3000 miles or 3 months, or when necessary after a fuel pressure test. When replacing the final fuel filter element, do so only after the primary strainer is cleaned and the secondary fuel filter element has been replaced.

b. Filter Element Replacement. The final fuel filter is identical to the secondary fuel filter and the procedures for replacing the filter element are the same. Refer to paragraph 2–52*c* for replacement of the filter element.

c. Filter Replacement. The final fuel filter is removed and installed in the same manner as the secondary fuel filter. Refer to paragraph 2–52*d* for removal and installation.

2–54. Fuel Solenoid Cutoff Valve

a. Description. The fuel solenoid cutoff valve is mounted on the engine fuel injection pump assembly. It is controlled by a switch on the driver's panel and is used to cut off the fuel supply and stop the engine.

b. Removal.

(1) Remove engine front and rear hatch cover. Refer to paragraph 2–36.

(2) Disconnect electrical lead from conductor at cutoff valve.

(3) Remove two screws and lockwashers securing valve assembly to fuel injection pump housing. Remove solenoid valve and discard gasket.

c. Installation. Use new gasket and refer to removal procedures and reverse sequence.

2–55. Heater Fuel Pump (XM791)

a. Description. An electrical fuel pump with shielded lead wire and capacitor (fig. 2–142) is mounted on the inner side of the left frame rail at the rear of the vehicle fuel tank.

b. Removal.

(1) Disconnect fuel inlet and fuel outlet pump (fig. 2–142).

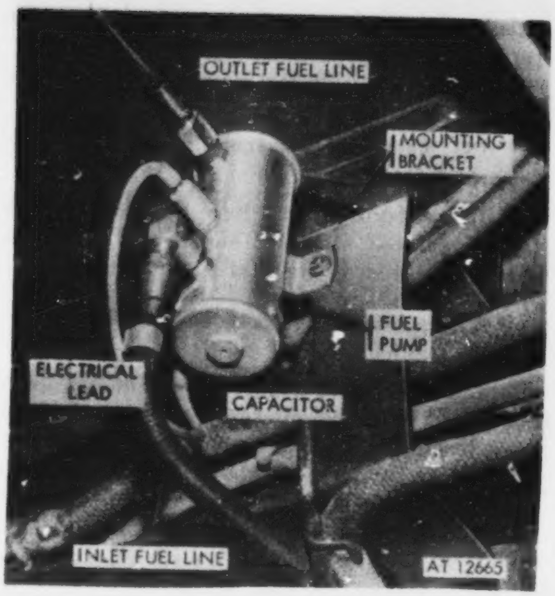


Figure 2–142. Heater fuel pump and capacitor.

(2) Disconnect electrical lead at lead connector of capacitor (fig. 2–142).

(3) Remove two screws, lockwashers and nuts securing pump assembly and capacitor to mounting bracket. Remove pump.

c. Installation. Refer to removal procedures and reverse sequence.

Note. Mating surfaces of capacitor, pump bracket and mounting bracket must be clean, free of paint, rust and corrosion for ground contact with the frame.

2–56. Fuel Lines and Fittings

a. Description. Refer to figures 2–128, 2–129, and 2–130 for location of the vehicle and engine low pressure fuel lines.

b. Removal.

(1) When disconnecting a fuel line, catch fuel drainage in a suitable container.

(2) Observe all safety precautions.

(3) Use proper tools to loosen line nuts and fittings.

c. Installation.

(1) When installing fuel lines having fer-

ruled collar fittings, make sure the collars are properly fitted to the lines.

(2) Tighten all fuel line nuts and fittings securely.

(3) Never kink a fuel line when installing.

(4) After fuel lines have been installed or fitting replaced, start the engine and check installed lines and fittings for fuel leaks.

2–57. Engine Accelerator and Throttle Control Rods

a. General. Speed and power of the engine is controlled by a foot-operated accelerator pedal mounted to the floor of the cab and a hand-operated throttle control mounted on the dash panel. Movement of the engine fuel injector control arm and the transmission throttle valve arm is accomplished through a series of adjustable rod assemblies (fig. 2–143).

b. Rod Assemblies Service. Refer to LO 9–2320–230–12 for service procedures performed on the accelerator and throttle control rod assemblies.

c. Accelerator Pedal Control Rod.

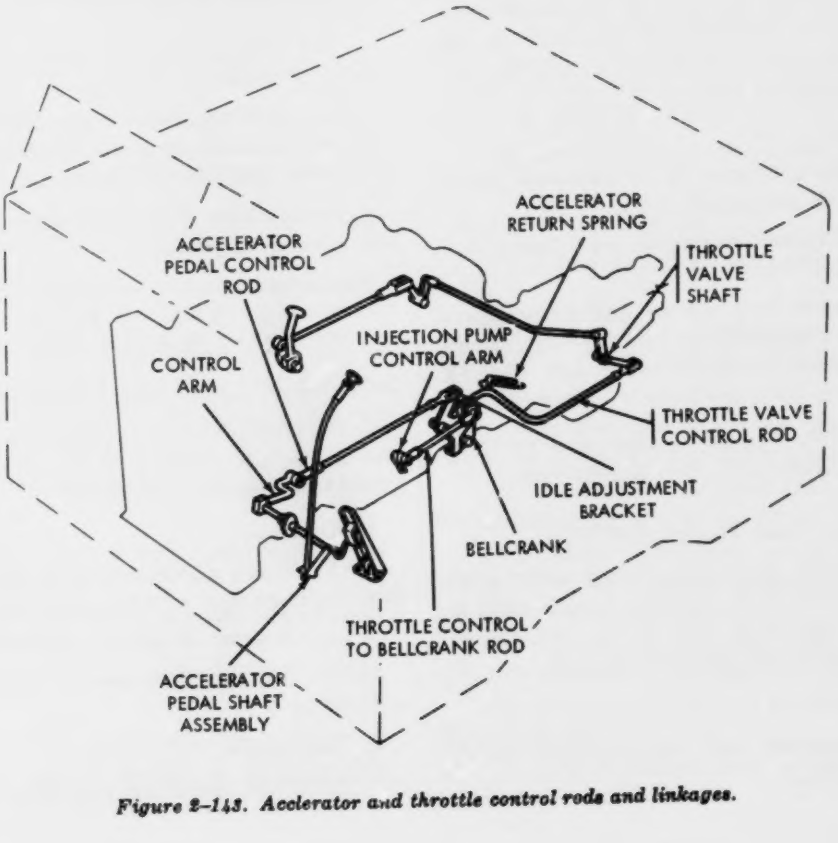
(1) *Removal.*

(*a*) Remove nut, lockwasher and bolt securing accelerator rod to accelerator control arm (fig. 2–144).

(*b*) Remove cotter pin and clevis pin securing control rod end clevis to over-control link arm of accelerator bellcrank assembly (fig. 2–145).

(2) *Cleaning, inspection, and repair.* Refer to *f* below for cleaning, inspection, and repair of the accelerator control rod assembly.

(3) *Installation.* Refer to removal procedures and reverse sequence.


ACCELERATOR PEDAL CONTROL ROD
ACCELERATOR RETURN SPRING
THROTTLE VALVE SHAFT
CONTROL ARM
INJECTION PUMP CONTROL ARM
THROTTLE VALVE CONTROL ROD
IDLE ADJUSTMENT BRACKET
BELLCRANK
THROTTLE CONTROL TO BELLCRANK ROD
ACCELERATOR PEDAL SHAFT ASSEMBLY

AT 12666

Figure 2–143. Acclerator and throttle control rods and linkages.

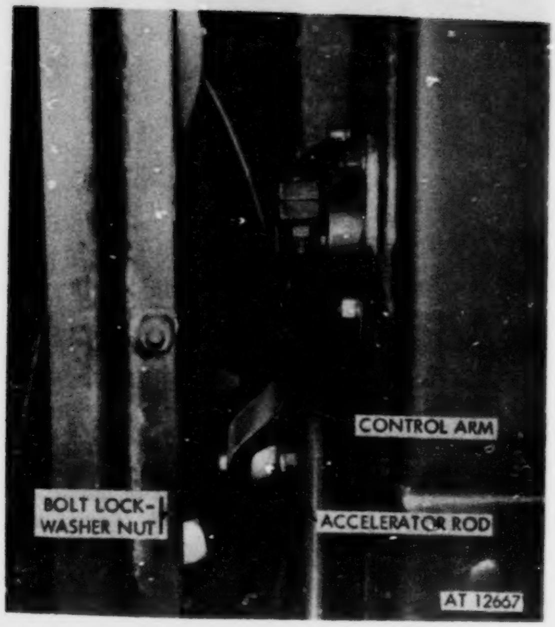

CONTROL ARM
BOLT LOCK-WASHER NUT
ACCELERATOR ROD
AT 12667

Figure 2–144. Accelerator rod and accelerator control arm.

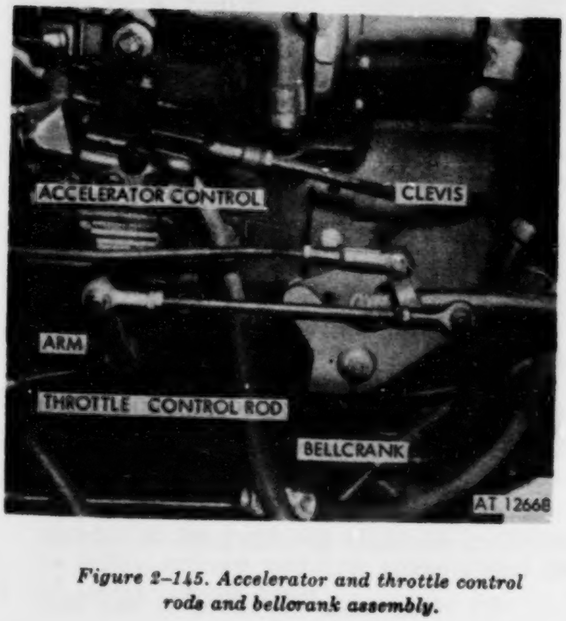

ACCELERATOR CONTROL
CLEVIS
ARM
THROTTLE CONTROL ROD
BELLCRANK
AT 12668

Figure 2–145. Accelerator and throttle control rods and bellcrank assembly.

(4) *Adjustment.* Refer to *g* below for adjustment of the accelerator pedal control rod.

d. Throttle Control to Bellcrank Rod.

(1) *Removal.*

(*a*) Remove nut, lockwasher and screw screw securing throttle control rod end to accelerator bellcrank (fig. 2–145).

(*b*) Remove nut, lockwasher and screw securing throttle control rod end to injector pump control arm (fig. 2–145). Remove rod assembly.

(2) *Cleaning, inspection, and repair.* Refer to *f* below for cleaning, inspection, and repair of the rod assembly.

(3) *Installation.* Refer to removal procedures and reverse sequence.

(4) *Adjustment.* Refer to *g* below for adjustment of the throttle control to bellcrank rod.

e. Transmission Throttle Valve Control Rod.

(1) *Removal.*

(*a*) Disconnect accelerator return spring from valve control rod.

(*b*) Remove cotter pin and clevis pin securing transmission throttle valve rod clevis to over-control link of accelerator bellcrank assembly (fig. 2–146).

(*c*) Remove cotter pin and clevis pin se-

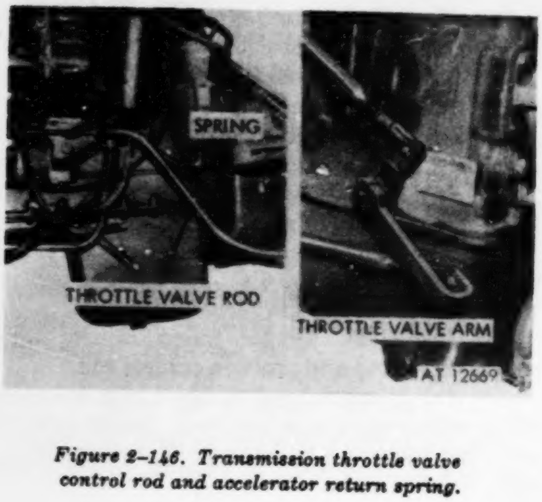

SPRING
THROTTLE VALVE ROD
THROTTLE VALVE ARM
AT 12669

Figure 2–146. Transmission throttle valve control rod and accelerator return spring.

curing throttle valve rod clevis to transmission throttle valve arm (fig. 2-146). Remove rod assembly.

(2) *Cleaning, inspection, and repair.* Refer to *f.* below for cleaning, inspection, and repair of throttle valve rod assembly.

Note. Replace accelerator return spring if stretched or damaged.

(3) *Installation.* Refer to removal procedures and reverse sequence.

(4) *Adjustment.* Refer to *g* below for adjustment of the transmission throttle valve control rod.

f. Cleaning, Inspection, and Repair of Rod Assemblies.

(1) *Cleaning.* Clean all rod assemblies with volatile mineral spirits or dry-cleaning solvent, making sure all threads and rod ends are clean of dirt and grit.

(2) *Inspection.*

(*a*) Inspect control rod assemblies for badly worn or damaged parts.

(*b*) Check for broken or worn rod ends, worn or cracked clevises and clevis pins.

(*c*) Check rod end threads for damage.

(3) *Repair.* Repair of rod assemblies consists of straightening rods and replacing damaged part where necessary.

g. Adjustment of Control Rods.

Note. When the length of an accelerator or throttle rod is changed, all control rods must be adjusted.

(1) *Adjustment of throttle control to bellcrank rod.*

(*a*) Disconnect throttle control to bellcrank rod from injector pump arm (fig. 2-145).

(*b*) Move bellcrank to idle position and aline idle-pin hole in accelerator bellcrank with hole in idle adjustment bracket (fig. 2-147).

(*c*) Insert a 5/16 x 1-inch pin or bolt in pin holes (fig. 2-147) to secure alinement.

(*d*) Hold injector pump control arm against idle stop and position control rod.

(*e*) If control rod end bolt hole does not aline with control arm bolt hole, loosen locknut securing rod end and adjust rod end as necessary to aline holes.

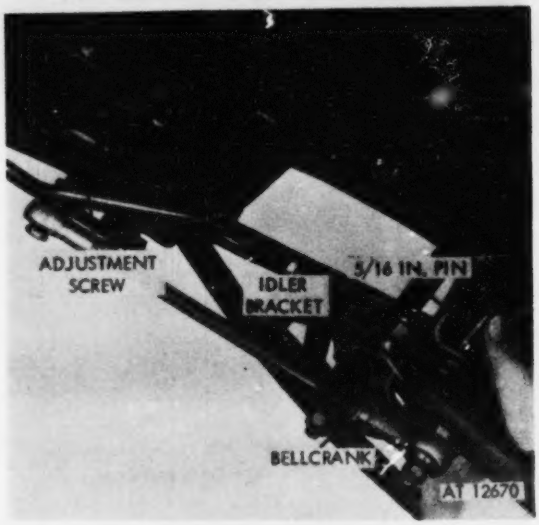


Figure 2-147 Accelerator bellcrank idle position and engine idle speed adjusting screw.

(*f*) When holes aline, install connecting screw, lockwasher, and nut in holes at each end of rod.

(*g*) Tighten locknut on rod and remove alinement pin.

(2) *Adjustment of accelerator pedal control rod.*

(*a*) Disconnect accelerator return spring (fig. 2-146).

(*b*) Remove nut, lockwasher and bolt, securing control rod end to accelerator control arm (fig. 2-144).

(*c*) Move bellcrank arm rearward through full fuel setting and over-control position until throttle arm contacts the transmission throttle valve stop.

Note. Throttle-valve stop is located inside the transmission.

(*d*) Hold bellcrank in this position and, with accelerator pedal arm resting on cab floor, position accelerator rod end on bellcrank control arm.

(*e*) Loosen rod end locknut and adjust rod end as necessary to aline holes in rod end and control arm.

(*f*) When holes are alined so that bolt may be inserted through arm and rod end freely with linkage in position described in (*e*), turn the rod end onto the rod 1-1/2 turns clockwise.

(*g*) Secure rod end to arm with screw, lockwasher, and nut.

(*h*) Tighten locknut on rod.

(3) *Adjustment of transmission throttle control rod.*

(*a*) Road test vehicle. Transmission should automatically up shift between 2700 and 2750 rpm at full detent position (full throttle position) with transmission selector in 3-6 position.

(*b*) If proper operation of shifting is not obtained at this speed, proceed as follows.

1. Remove cotter pin and clevis pin securing throttle valve rod to transmission shifter shaft arm and lengthen or shorten rod to obtain correct shifting point.

Note. Loosen locknut and turn clevis clockwise to increase shifting rpm, or counterclockwise to lower shifting point.

2. Replace clevis pin and cotter pin and tighten locknut on rod when proper adjustment has been obtained.

(4) *Engine idle speed adjustment.*

(*a*) After the engine accelerator and throttle rods have been properly adjusted, the engine idle speed should be checked.

Note. The engine idle speed should be 600-700 rpm.

(*b*) The engine idle speed is adjusted by loosening the locknut on the injection pump idle screw (fig. 2-147) and slowly turn the idle screw until the proper speed has been obtained.

Note. Turning the screw clockwise decreases the rpm of the engine, counterclockwise increases the rpm.

(*c*) When proper speed has been obtained, hold screw and tighten locknut.

Section XIII. ENGINE AIR INDUCTION SYSTEM

2-58. General

This section contains the service and replacement procedures for the engine air induction system components (fig. 2-148). These components consist of the air cleaner and element, air cleaner indicator, air ducts and hoses, and the manifold heater wiring harness, fuel lines and fittings, spark plug, fuel nozzle and fuel filter.

2-59. Description

a. Air Cleaner. The dry-type filter element air cleaner is mounted in the right rear of the cab behind the co-driver's seat. An air intake tube with rain cap is mounted to the inlet neck of the cleaner housing and protrudes upward behind the cab into ambient air. Filtered air is drawn from the cleaner through an air duct assembly and hoses to the engine turbocharger and air compressor.

b. Turbocharger. The engine turbocharger is mounted on the right side of the engine below the engine exhaust manifold and is driven by the engine exhaust gases.

c. Air Cleaner Indicator. An air cleaner indicator is mounted on the right side of the driver's instrument panel to provide the driver with a visual indication of air flow restriction and indicates when the cleaner should be serviced.

d. Engine Manifold Air Heater. A flame-type intake air heater is mounted in the elbow between the turbocharger air outlet and intake manifold and is used to warm the induction air during cold weather starting and warmup of the engine. Refer to paragraph 2-65 for a description of the engine manifold heater fuel lines.

e. Air Compressor. The vehicle air compressor is mounted to a base at the left front side of the engine and is driven by a "V" belt off the engine crankshaft pulley. Filtered air for the compressor is taken from the engine air duct located inside the cab.

2-60. Engine Air Cleaner Service

Clean air cleaner element every 1000 miles or replace if damaged or unserviceable. For ex-

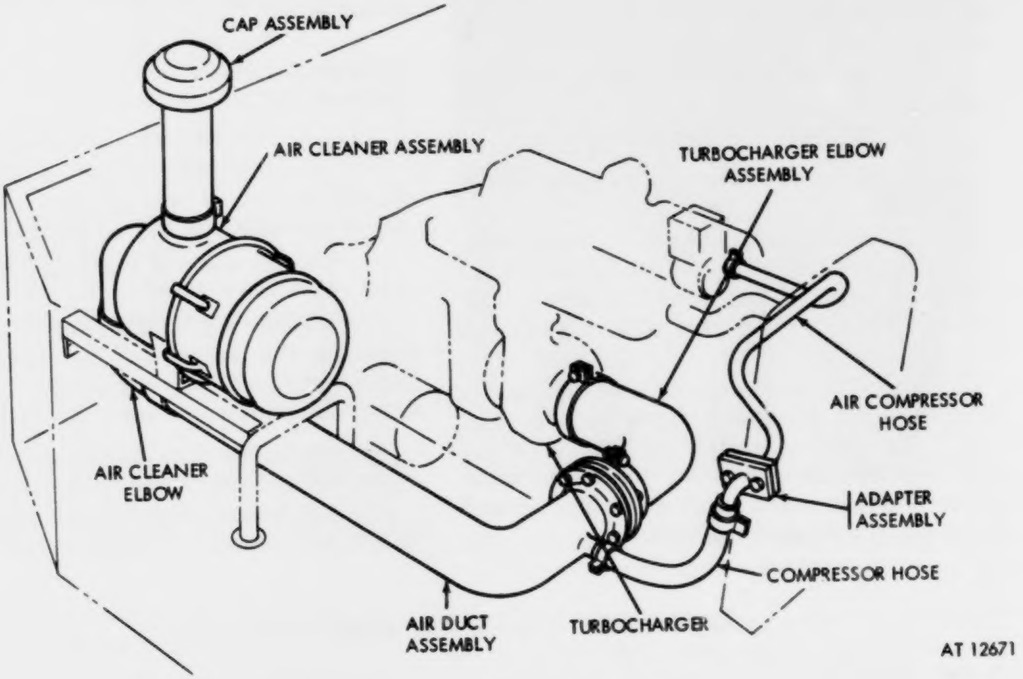

CAP ASSEMBLY
AIR CLEANER ASSEMBLY
TURBOCHARGER ELBOW ASSEMBLY
AIR COMPRESSOR HOSE
ADAPTER ASSEMBLY
COMPRESSOR HOSE
AIR CLEANER ELBOW
AIR DUCT ASSEMBLY
TURBOCHARGER
AT 12671

Figure 2-148. Engine air induction system diagram.

tremely dusty operations, clean or replace element as required by restriction indicator reading.

a. Unfasten four latches holding air cleaner cup to manifold (fig. 2-149).

b. Unfasten band latch (fig. 2-149) securing cup and band assembly to support assembly.

c. Pull cup and band assembly straight forward and remove.

d. Remove filter element from manifold assembly (fig. 2-150).

e. Clean dust from cup and manifold.

(1) Wipe inside of manifold and cup clean with lint-free cloth.

(2) Clean filter element from inside outward (fig. 2-151) using dry compressed air.

f. Inspect air duct for restrictions. Clean as necessary.

g. Install element, gasket, cup and band assembly (fig. 2-152) using care when installing gasket, making sure it is properly positioned.

Note. Position cup and band assembly on manifold assembly so that arrows on cup point upward (fig. 2-149) and so that band is under support assembly flange.

h. Secure cup and bank assembly to manifold assembly with four latches (fig. 2-149).

i. Secure cup to mounting bracket by fastening band latch (fig. 2-149).

2-61. Engine Air Cleaner

a. Removal.

(1) Loosen clamp securing cap assembly to air cleaner manifold (fig. 2-150). Remove cap assembly.

(2) Loosen latch on band securing cup and band assembly to support assembly (fig. 2-153).

(3) Disconnect air cleaner indicator vac-

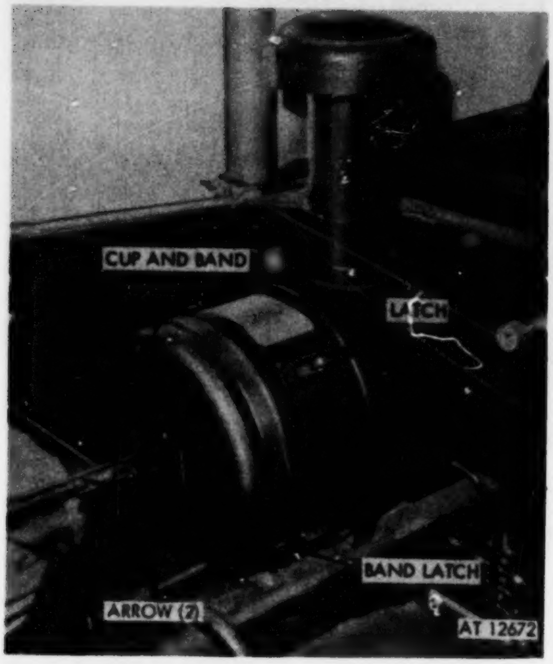


Figure 2-149. Engine air cleaner.

uum line from fitting at rear of cleaner manifold (fig. 2-153).

(4) Loosen clamp on upper end of elbow at air cleaner outlet.

(5) Remove two bolts, lockwashers and nuts securing manifold brackets to mounting bracket (fig. 2-153) and remove engine air cleaner assembly.

b. Repair.

(1) To remove the air cleaner cup and band assembly and element from the manifold assembly, refer to paragraph 2-60.

(2) The air cleaner manifold assembly, cup and band assembly, and/or cap assembly may be straightened when dented, or welded when seams or brackets are damaged.

c. Installation. After the air cleaner has been serviced, repaired, or replaced, refer to removal procedures and reverse sequence.

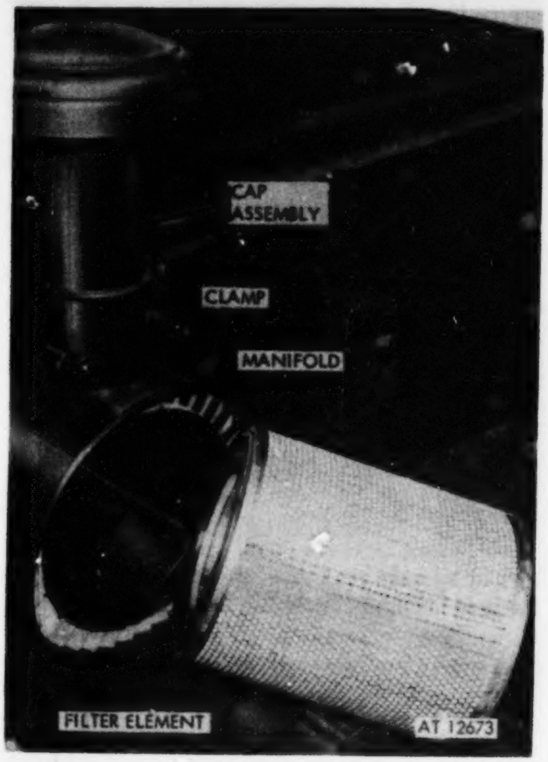


Figure 2-150. Air cleaner, filter element removed.

2-62. Air Cleaner Indicator

a. Removal.

(1) Disconnect vacuum line at indicator (fig. 2-154).

(2) Remove two screws, flat washers, lockwashers, and nuts securing air cleaner indicator to dash panel (fig. 2-154). Remove air cleaner indicator assembly.

b. Installation. Refer to removal procedure and reverse sequence.

2-63. Air Ducts and Hoses

a. Air Cleaner Outlet Elbow.

(1) *Removal.*

(*a*) Loosen two clamps securing outlet elbow to air cleaner manifold and air duct on cab floor (fig. 2-153).

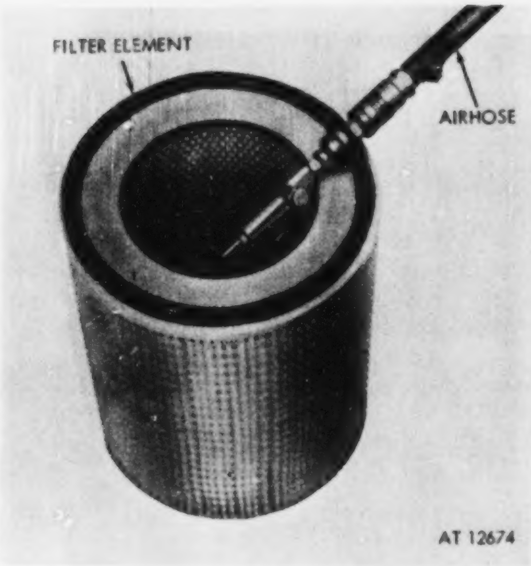

FILTER ELEMENT
AIRHOSE
AT 12674

Figure 2-151. Cleaning filter element.

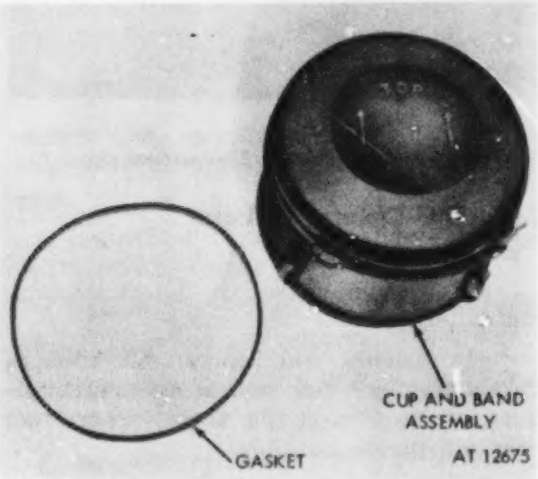

CUP AND BAND ASSEMBLY
GASKET
AT 12675

Figure 2-152. Air cleaner cup and gasket.

(*b*) Remove elbow from air cleaner manifold and from air duct.

(2) *Installation.* Refer to removal procedures and reverse sequence.

b. Air Duct Assembly.

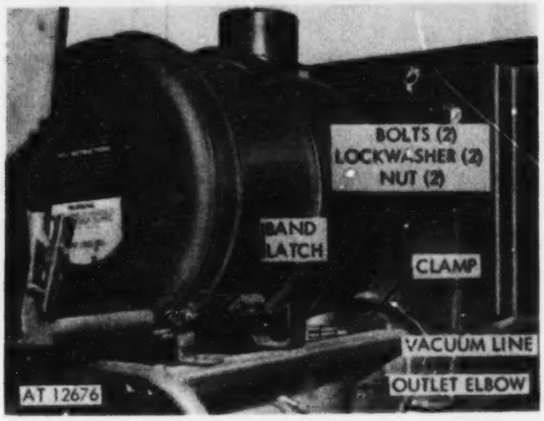

BOLTS (2)
LOCKWASHER (2)
NUT (2)
BAND LATCH
CLAMP
VACUUM LINE
OUTLET ELBOW
AT 12676

Figure 2-153. Air cleaner disconnect points.

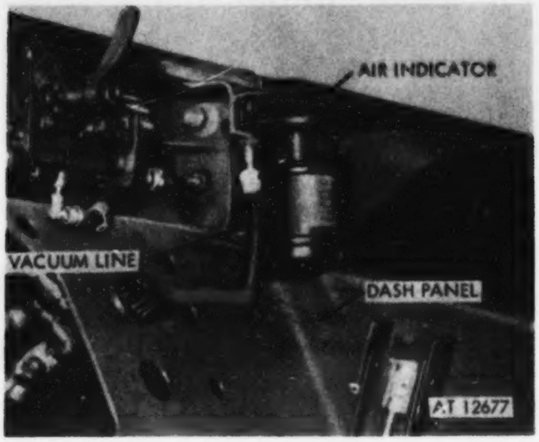

AIR INDICATOR
VACUUM LINE
DASH PANEL
AT 12677

Figure 2-154. Air cleaner indicator.

(1) *Removal.*

(*a*) Remove engine front and rear hatch covers. Refer to paragraph 2-36.

(*b*) Loosen clamp securing turbocharger inlet elbow to air duct (fig. 2-155). Disconnect elbow from duct.

(*c*) Loosen clamp securing air compressor inlet hose to air duct (fig. 2-156). Disconnect hose from air duct.

(*d*) Remove 6 screws, 12 flat washers, 6

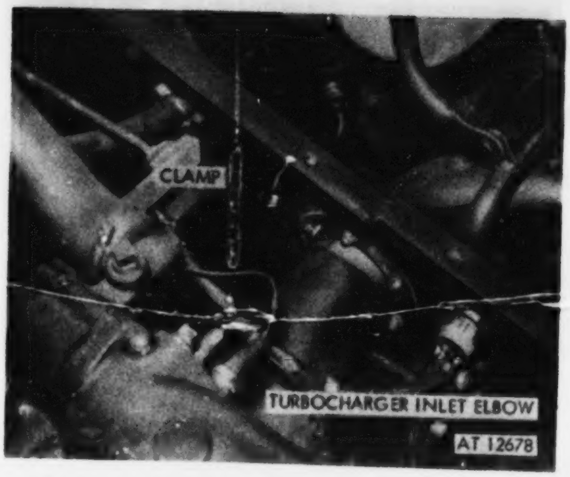

CLAMP
TURBOCHARGER INLET ELBOW
AT 12678

Figure 2-155. Turbocharger inlet elbow.

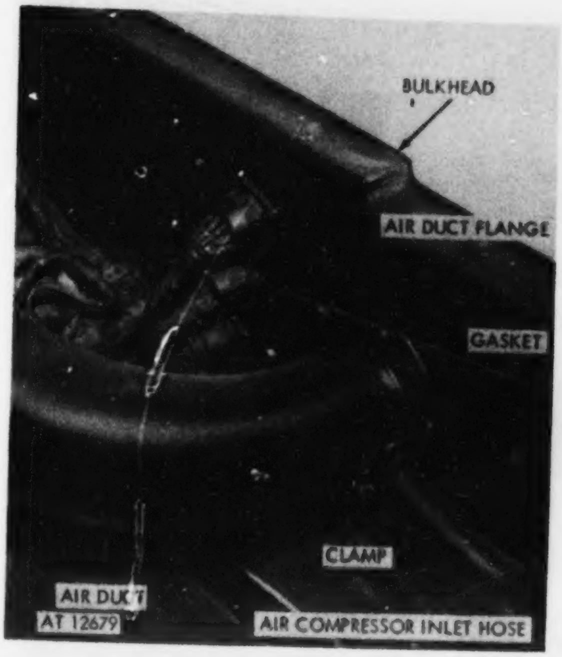

BULKHEAD
AIR DUCT FLANGE
GASKET
CLAMP
AIR DUCT
AT 12679
AIR COMPRESSOR INLET HOSE

Figure 2-156. Air duct flange and compressor air hose.

lockwashers, and 6 nuts securing air duct flange to engine bulkhead (fig. 2-156).

(*f*) Pull air duct flange from bulkhead opening and then forward and upward to remove.

(*g*) Remove and discard air duct flange gasket (fig. 2-156).

(2) *Installation.* Refer to removal procedures and reverse sequence.

c. Air Compressor Hose (Inside Cab.).

(1) *Removal.* Loosen two clamps securing air compressor intake hose to air duct and adapter (fig. 2-157). Remove hose.

(2) *Installation.* Refer to removal procedures and reverse sequence.

d. Air Compressor Inlet Hose.

(1) *Removal.*

(*a*) Remove engine front and rear hatch covers. Refer to paragraph 2-36.

(*b*) Remove three screws, lockwashers and nuts securing air inlet hose clamps to fan shroud and upper radiator support bracket (fig. 2-158).

(*c*) Loosen two clamps securing air inlet hose to adapter on right bulkhead and air compressor inlet elbow. Remove hose.

(2) *Installation.* Refer to removal procedures and reverse sequence.

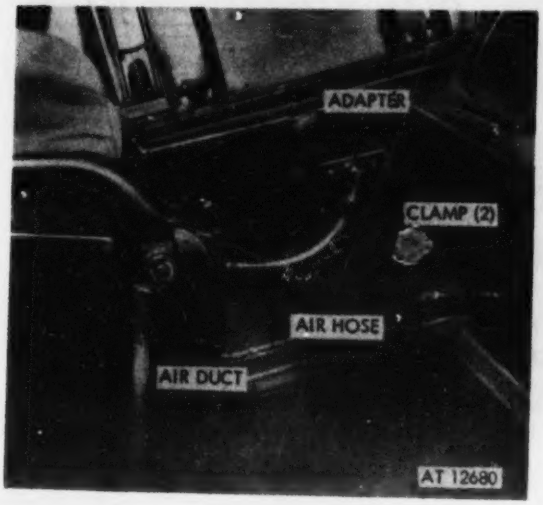

ADAPTER
CLAMP (2)
AIR HOSE
AIR DUCT
AT 12680

Figure 2-157. Air compressor intake hose.

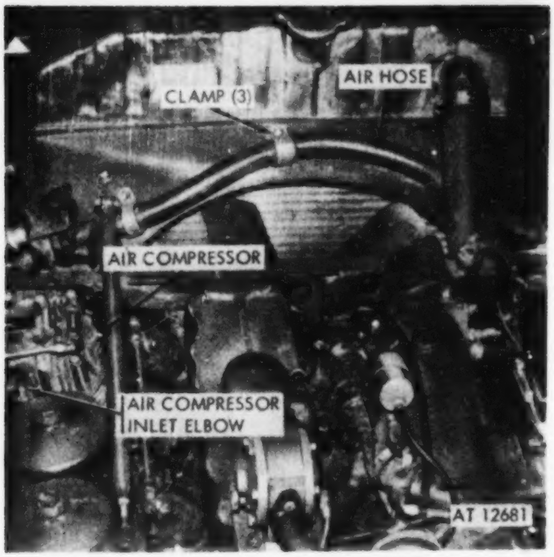

CLAMP (3)
AIR HOSE
AIR COMPRESSOR
AIR COMPRESSOR INLET ELBOW
AT 12681

Figure 2-158. Air compressor inlet hose and mounting clamps.

e. Air Compressor Airhose Adapter.

(1) *Removal.*

(*a*) Remove front and rear engine hatch covers. Refer to paragraph 2-36.

(*b*) Loosen two hose clamps and disconnect air inlet hoses (fig. 2-157) from adapter.

(*c*) Remove two screws, flat washers, lockwashers and nuts securing adapter assembly to bulkhead (fig. 2-157).

(*d*) Remove adapter assembly and discard gasket.

(2) *Installation.* Refer to removal procedures and reverse sequence using new gasket.

f. Turbocharger Elbow Assembly.

(1) *Removal.*

(*a*) Remove engine front and rear hatch covers. Refer to paragraph 2-36.

(*b*) Loosen clamp securing elbow assembly to air duct at bulkhead (fig. 2-155).

(*c*) Loosen clamp securing elbow assembly to turbocharger (fig. 2-159). Remove elbow.

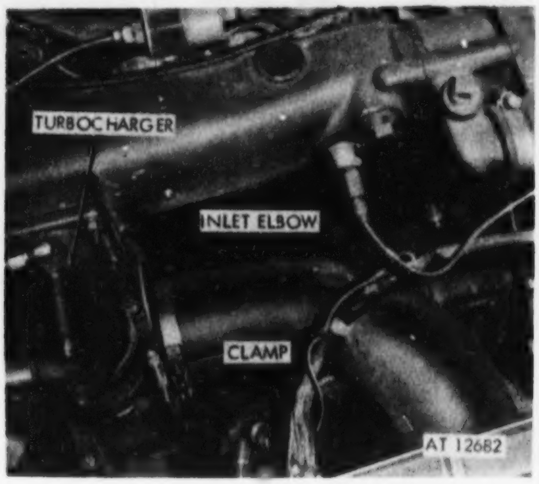

TURBOCHARGER
INLET ELBOW
CLAMP
AT 12682

Figure 2-159. Turbocharger elbow assembly.

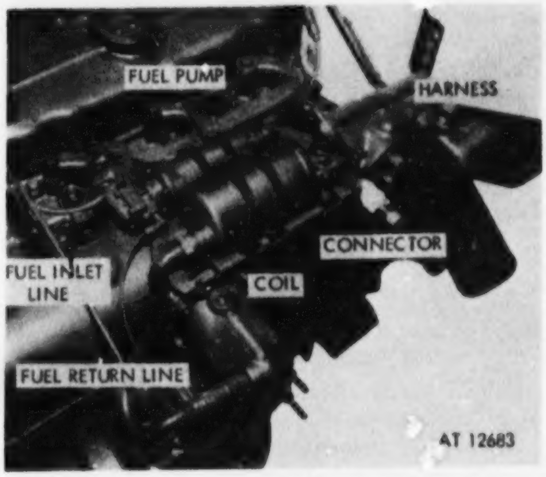

FUEL PUMP
HARNESS
CONNECTOR
FUEL INLET LINE
COIL
FUEL RETURN LINE
AT 12683

Figure 2-160. Manifold heater electrical harness and fuel lines.

(2) *Installation.* Refer to removal procedures and reverse sequence.

2-64. Manifold Heater Wiring Harness

Note. **When doing any work on the engine manifold heater components, the engine hatch covers must be removed. Refer to paragraph 2-36 for removal.**

a. Removal (Fig. 2-160).

(1) Remove manifold heater cover (fig. 2-161).

(2) Disconnect heater harness electrical lead from engine harness.

(3) Disconnect connector from ignition coil.

(4) Disconnect harness connector from fuel pump.

(5) Remove screw, lockwasher and nut securing harness ground lead to mounting bracket. Remove harness.

b. Installation. Refer to removal procedures and reverse sequence.

2-65. Manifold Heater Fuel Lines

a. Description. Fuel for the operation of the engine manifold heater (fig. 2-161) is taken from a fuel line fitting on the engine fuel injector. The heater fuel filter is secured to the left side of the engine block rearward of the injector. A fuel line from the filter extends upward along the side of the engine to the heater fuel pump mounted on a bracket atop the engine intake manifold. Fuel from the heater fuel pump is delivered to the heater nozzle through a plastic line. The return fuel from the nozzle is returned through a plastic line to the engine nozzle fuel return line at a "T" fitting between number 3 and 4 cylinder nozzles.

b. Removal.

(1) Remove engine rear hatch cover. Refer to paragraph 2-36.

(2) Loosen fittings and remove line(s) as necessary.

c. Installation. Refer to removal procedures and reverse sequence.

2-66. Manifold Heater Fuel Filter

a. Removal.

(1) Remove engine rear hatch cover. Refer to paragraph 2-36.

(2) Disconnect fuel "in" and fuel "out" line from filter (fig. 2-162).

b. Installation. Refer to removal procedure and reverse sequence.

2-67. Manifold Heater Fuel Nozzle

a. Removal.

(1) Remove engine rear hatch cover. Refer to paragraph 2-36.

(2) Disconnect fuel lines from nozzle (fig. 2-163).

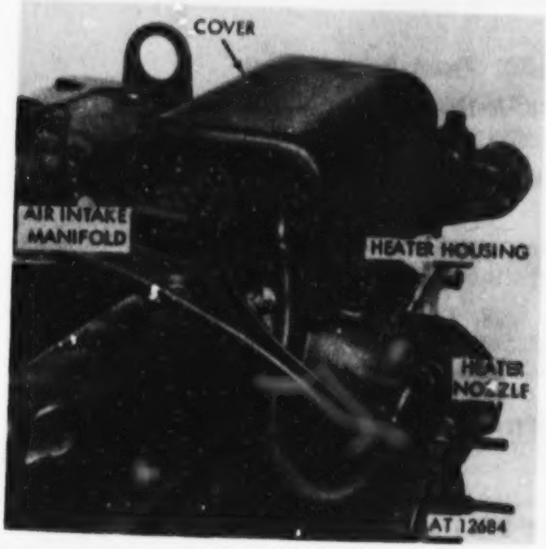


Figure 2-161. Engine manifold heater assembly.

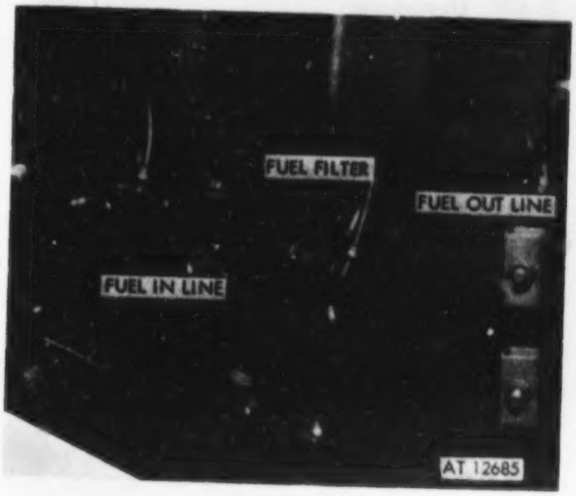


Figure 2-162. Manifold heater fuel filter and lines.

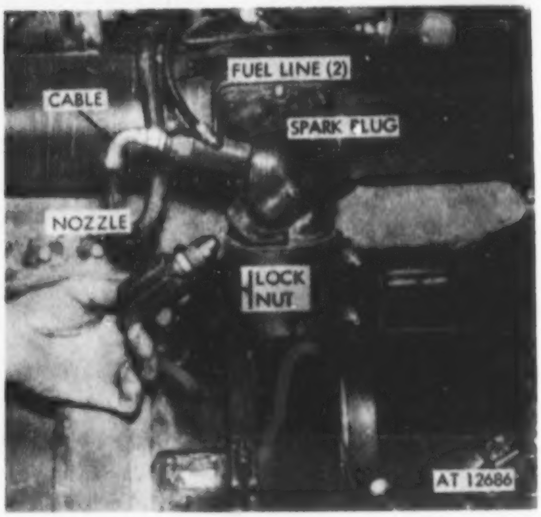


Figure 2-163. Manifold heater nozzle removed.

(2) Remove two line fittings from nozzle.

(3) Loosen locknut and unscrew nozzle from heater housing (fig. 2-163).

b. Installation. Refer to removal procedures and reverse sequence.

2-68. Manifold Heater Spark Plug

a. Removal.

(1) Remove engine rear hatch cover. Refer to paragraph 2-36.

(2) Unscrew nut securing shielded ignition cable to spark plug. Remove cable and spring connector (fig. 2-163).

(3) Remove spark plug and discard gasket.

b. Installation.

(1) Clean spark plug on a spark plug cleaner and tester. Adjust gap for 0.028 to 0.032 inch.

(2) Use new spark plug gasket and refer to removal procedures and reverse sequence.

(3) Tighten spark plug to 18-20 lb-ft.

Note. Ignition cable nut should be finger tight plus an additional one-half turn.

Section XIV. ENGINE EXHAUST SYSTEM

2-69. Description

a. The exhaust system for the engine (fig. 2-164) consists of a 4-piece pipe connected by a coupling and secured by a clamp to the cab at the right rear corner of the cab.

b. The front exhaust pipe is connected to the rear of the turbocharger and extends rearward where it connects with the front-intermediate pipe which carries the exhaust gases rearward and upward to the intermediate pipe that extends upward along the right rear corner of the vehicle cab and is protected by a heat shield mounted by three clamp straps to cab storage compartment wall.

c. The exhaust extension pipe is connected to the intermediate pipe and extends upward beyond the height of the cab and cargo box top where the gases are discharged into the air.

2-70. Front Exhaust Pipe

a. Removal.

(1) Remove engine rear hatch cover. Refer to paragraph 2-36.

(2) Loosen hose clamp and disconnect engine crankcase breather hose from exhaust pipe tube (fig. 2-165).

(3) Loosen coupling securing exhaust pipe to turbocharger (fig. 2-165).

(4) Loosen clamp securing front exhaust pipe to front-intermediate pipe (fig. 2-164). Pull intermediate pipe rearward.

(5) Remove front exhaust pipe and intermediate pipe gasket. Discard gasket.

b. Installation. Refer to removal procedures and using new gasket, reverse sequence.

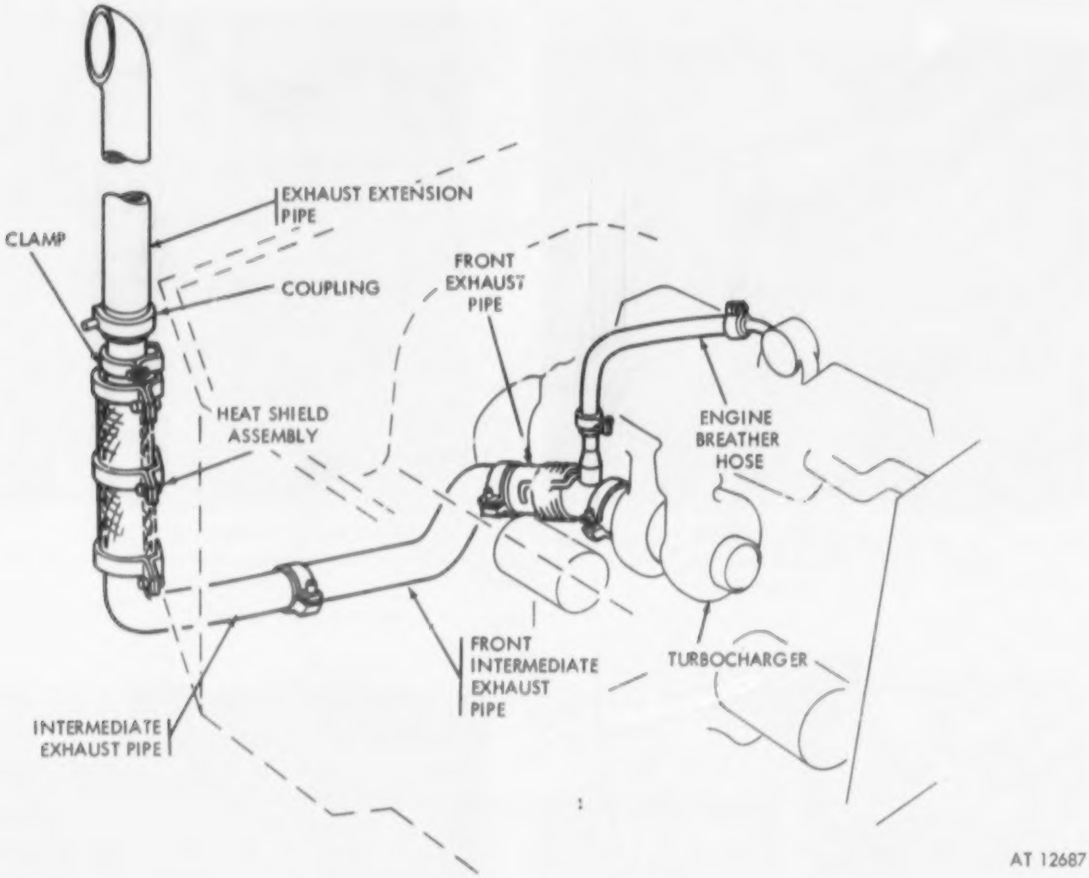

CLAMP
EXHAUST EXTENSION PIPE
COUPLING
FRONT EXHAUST PIPE
HEAT SHIELD ASSEMBLY
ENGINE BREATHER HOSE
FRONT INTERMEDIATE EXHAUST PIPE
TURBOCHARGER
INTERMEDIATE EXHAUST PIPE
AT 12687

Figure 2-164. Engine exhaust system diagram.

2-71. Front-Intermediate Exhaust Pipe

a. Removal.

(1) Remove engine hatch cover (para 2-36).

(2) Loosen clamp securing front-intermediate exhaust pipe to front exhaust pipe (fig. 2-164).

(3) Loosen clamp securing front-intermediate exhaust pipe to intermediate exhaust pipe (fig. 2-166).

(4) Pull intermediate pipe rearward and remove front-intermediate pipe and two gaskets. Discard gaskets.

2-72. Exhaust Extension and Intermediate Exhaust Pipes

a. Removal.

(1) Loosen coupling securing exhaust extension pipe to intermediate pipe (fig. 2-167). Remove extension pipe and discard gasket.

(2) Loosen coupling securing intermediate pipe to front-intermediate exhaust pipe (fig. 2-166).

(3) Separate pipes and remove and discard gasket.

(4) Remove three bolts, and flat washers securing exhaust pipe heat shield strap to cab

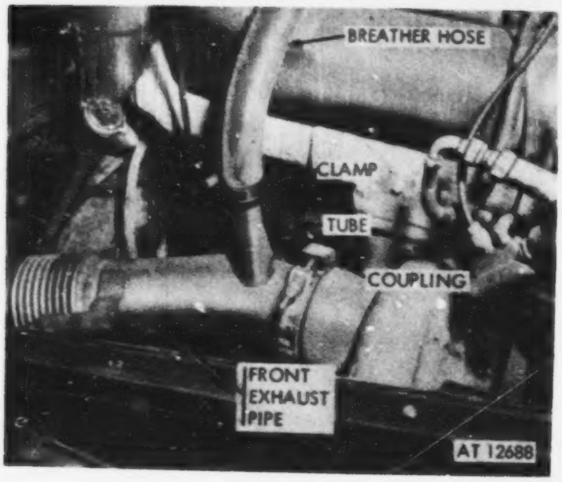

BREATHER HOSE
CLAMP
TUBE
COUPLING
FRONT EXHAUST PIPE
AT 12688

Figure 2-165. Front exhaust pipe and turbocharger coupling.

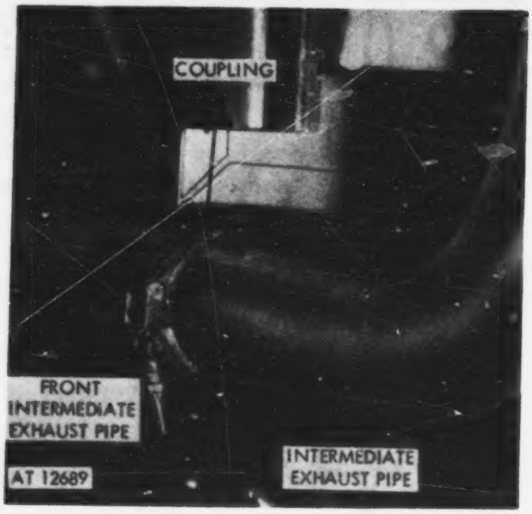

COUPLING
FRONT INTERMEDIATE EXHAUST PIPE
INTERMEDIATE EXHAUST PIPE
AT 12689

Figure 2-166. Front intermediate and intermediate exhaust pipe coupling.

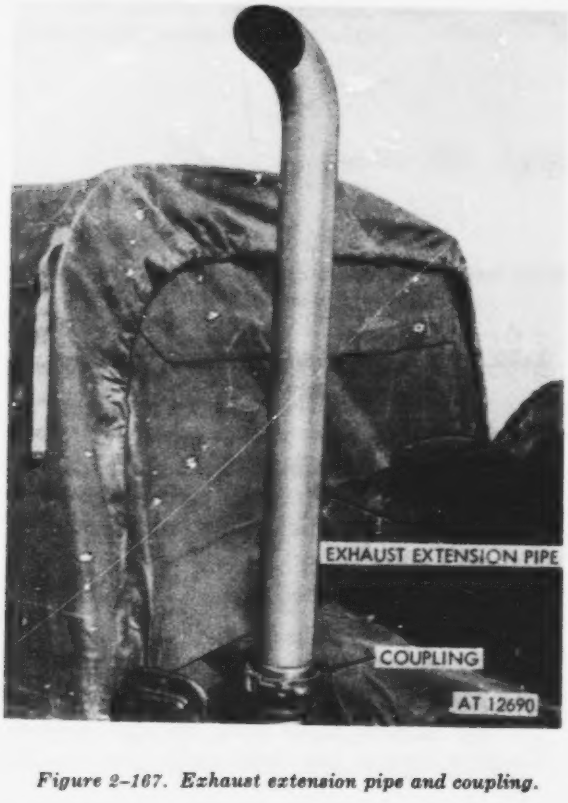

EXHAUST EXTENSION PIPE
COUPLING
AT 12690

Figure 2-167. Exhaust extension pipe and coupling.

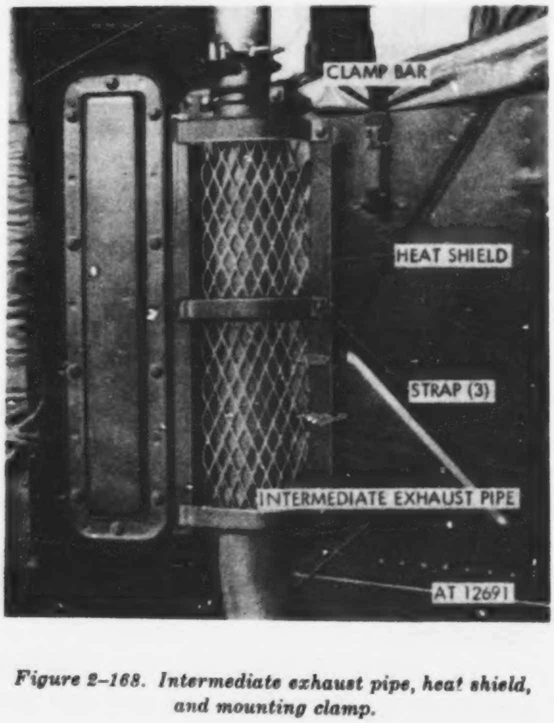

CLAMP BAR
HEAT SHIELD
STRAP (3)
INTERMEDIATE EXHAUST PIPE
AT 12691

Figure 2-168. Intermediate exhaust pipe, heat shield, and mounting clamp.

wall (fig. 2-168). Remove heat shield.

(5) Remove two bolts, lockwashers and nuts securing exhaust pipe clamp bar mounted to upper rail of the cab stowage compartment (fig. 2-168). Remove clamp bar and intermediate exhaust pipe.

b. Installation. Refer to removal procedures ant using two new gaskets, reverse sequence.

Note. The exhaust extension pipe opening must face outward from the side of the vehicle.

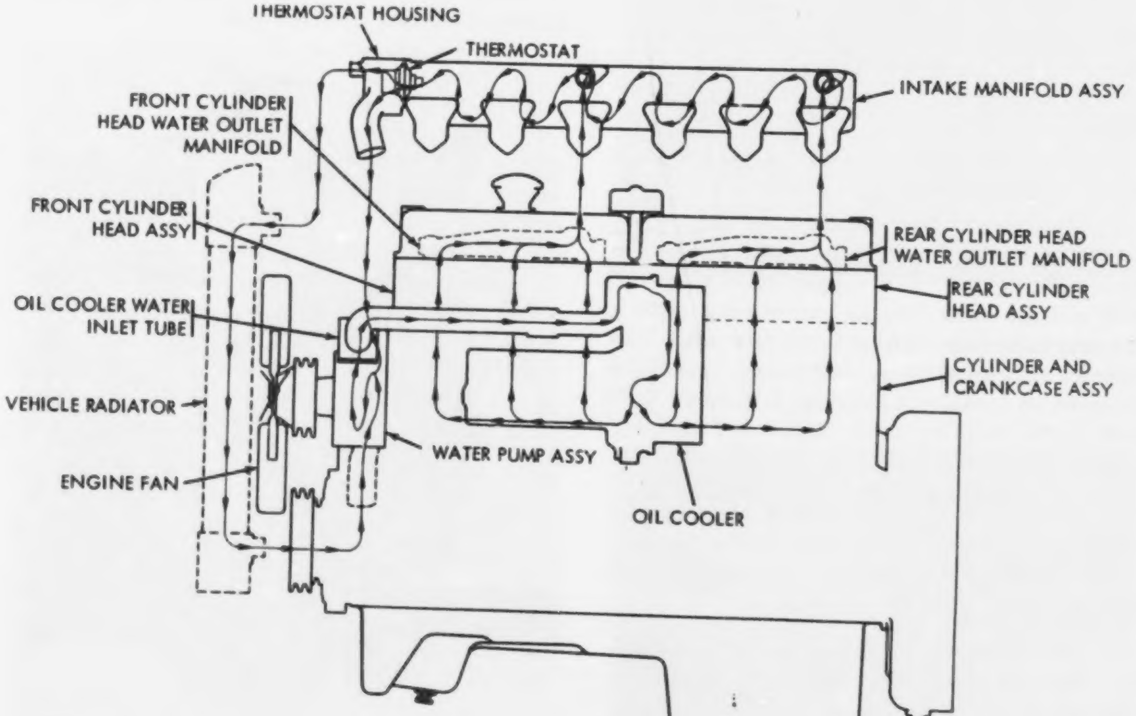
Section XV. ENGINE COOLING SYSTEM

2-73. General

This section contains service and test procedures for the engine cooling system and instructions for removal and installation of the engine cooling system components. These components consist of the engine coolant radiator, radiator hoses, engine fan, water pump and thermostat. This section also contains removal, installation and adjustment procedures for the alternator and fan drive belts and the fan belt idler assembly.

2-74. Description

a. General. The cooling system (fig. 2-169) consists of a coolant radiator, transmission oil cooler, water pump, fan, water pump and fan drive belts, engine coolant thermostat, coolant hoses and oil lines for connecting the cooling


THERMOSTAT HOUSING
THERMOSTAT
INTAKE MANIFOLD ASSY
FRONT CYLINDER HEAD WATER OUTLET MANIFOLD
FRONT CYLINDER HEAD ASSY
REAR CYLINDER HEAD WATER OUTLET MANIFOLD
REAR CYLINDER HEAD ASSY
OIL COOLER WATER INLET TUBE
CYLINDER AND CRANKCASE ASSY
VEHICLE RADIATOR
WATER PUMP ASSY
ENGINE FAN
OIL COOLER

AT 12692

Figure 2-169. Engine cooling system schematic drawing.

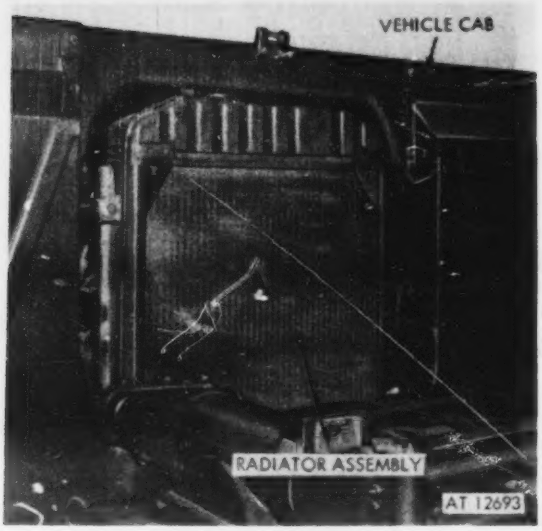


Figure 2-170. Engine radiator assembly, mounted position.

system components to the engine and transmission.

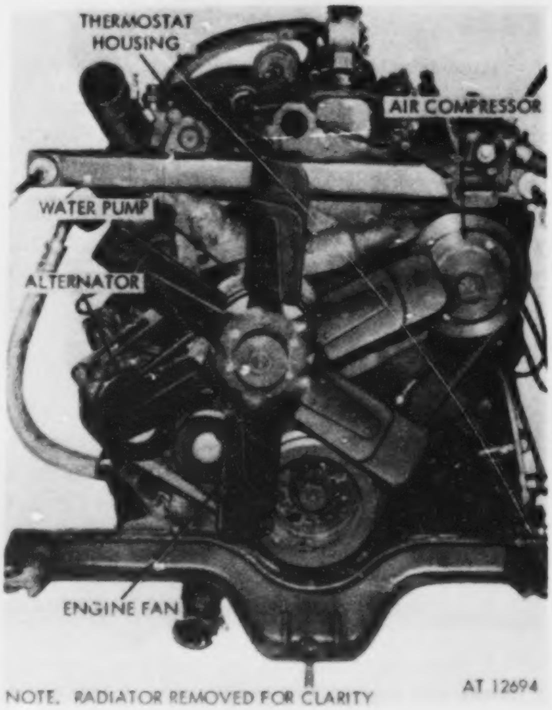
Note. The cooling system for the transmission oil is covered in section XXII of this manual.

b. Radiator. The coolant radiator (fig. 2-170) is mounted vertically in front of the engine and consists of a fin-and-tube-type core with a drain cock, and an upper tank with a pressure-type filler cap and overflow tube. The radiator transmission oil cooler and shroud are mounted on insulators near the bottom on both sides of the radiator to the engine and radiator support bracket, and the radiator, transmission oil cooler and shroud are secured in the vertical position by two stay rods with insulators at both ends connected to the sides of the radiator and the transmission selector and radiator support bracket.

c. Water Pump. The water pump is a centrifugal impeller-type drive assembly mounted in a housing bolted to the front of the engine block and driven by the three alternator drive belts (fig. 2-171).

d. Fan. The 6-blade fan is mounted to the front face of the fan pulley hub assembly by six capscrews and lockwashers (fig. 2-171). The fan is driven by two drive belts operating off the engine crankshaft belt pulley assembly.

e. Thermostat. A bypass-type thermostat mounted in a housing controls the temperature of the engine coolant while the engine is running. It is mounted inside the thermostat housing (fig. 2-171). The thermostat is equipped with a valve which is in the bypass position whenever the engine coolant temperature is below 160° F., thereby preventing the flow of coolant from the engine to the radiator. Consequently, when the thermostat valve is in the bypass position and the engine is running, the coolant circulates through the engine and the temperature rises rapidly. As the coolant temperature rises above 160° F., the thermostat valve closes the bypass and opens the outlet to the radiator. At this temperature, the thermostat valve should permit unrestricted circulation of the coolant through the engine, engine oil cooler and radiator.



NOTE. RADIATOR REMOVED FOR CLARITY

Figure 2-171. Engine fan, water pump and thermostat housing.

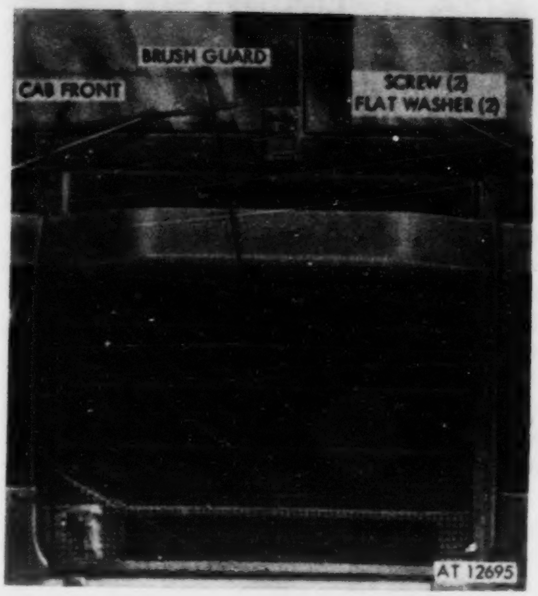

BRUSH GUARD
CAB FRONT
SCREW (2)
FLAT WASHER (2)
AT 12695

Figure 2-172. Radiator brush guard.

2-75. Servicing Cooling System

a. General. If air or exhaust gases leak into the cooling system they will cause rapid corrosion and rust formations. Corrosion and rust will eventually clog the system and cause engine overheating and loss of coolant in the radiator. Exhaust gases are sometimes blown into the cooling system past the cylinder head gasket or through crack(s) in the cylinder head or block assemblies.

b. Air Leak Test. Bring level of coolant in the radiator to two inches below the fill neck. At this level no coolant will be thrown out the overflow tube while performing the test. Be sure the radiator cap is in good condition and is an airtight seal. Attach a length of rubber tubing to the lower end of the overflow tube, making sure that the tubing condition is airtight. Run engine at 1150 to 1200 rpm until temperature gage stops rising and remains stationary. Without changing engine speed, place end of rubber tubing in a bottle of clean water, making sure there are no kinks or sharp bends in the tubing to restrict airflow. Check for bubbles in the water. Bubbles indicate that air or combustion gas is being forced into the cooling system. Notify direct support personnel. Examine all hose carefully, and if cracked, swollen, or deteriorated in any way, replace hoses(s).

c. Preventive Cleaning. In order to efficiently clean the cooling system of rust, scale, or sludge, use a cleaner, followed by a neutralizer to stop action of cleaner. Cleaning compound 51-C-1568-500 provides enough cleaner and neutralizer to clean a cooling system of 4-gallon capacity. Neutralizing and flushing after neutralizing are very important, as the cleaner

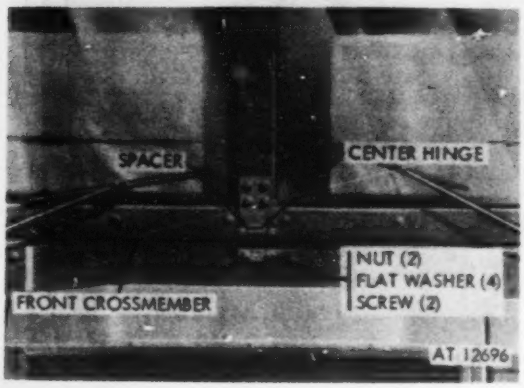

SPACER
CENTER HINGE
NUT (2)
FLAT WASHER (4)
SCREW (2)
FRONT CROSSMEMBER
AT 12696

Figure 2-173. Windshield center hinge.

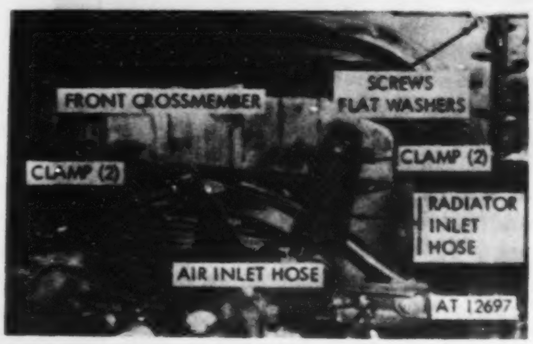

FRONT CROSSMEMBER
SCREWS
FLAT WASHERS
CLAMP (2)
CLAMP (2)
RADIATOR
INLET
HOSE
AIR INLET HOSE
AT 12697

Figure 2-174. Cab upper front crossmember.

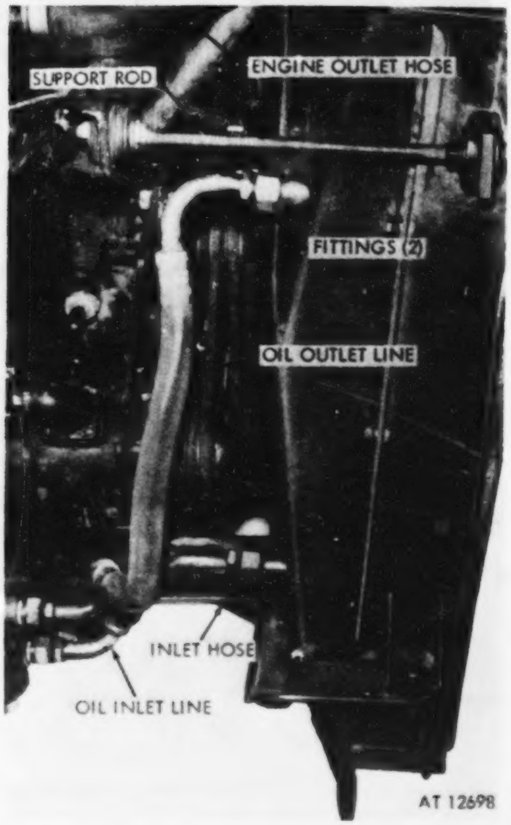


Figure 2-175. Right front side of power plant.

contains a strong acid which, if not completely removed, will attack the parts of the cooling system. Also precautions should be taken not to spill any cleaning compound on skin, clothing, or vehicle paint.

Caution: **Do not pour cold water or coolant liquid into cooling system when engine temperature is above 200° F. Also cold water or coolant liquid poured into cooling system, regardless of engine temperature, will close thermostats and not allow engine water jackets and passages to completely fill. After adding cold water or coolant liquid to system, always run engine until normal operating temperature is reached (thermostats open), then add water or coolant liquid until coolant reaches proper coolant level.**

(1) *Drain system.* Run engine at fast idle until normal engine temperature (at least 145° F.) is reached and then stop engine. Remove radiator cap, open radiator drain cock, and cylinder block drain cock, and allow cooling system to drain.

(2) *Clean system.* Close radiator and cylinder block drain cocks. Place a clean container under overflow tube to catch any overflow, which may be needed to maintain proper level in the radiator. Be sure temperature of engine is below 200° F. Pour cleaning compound (one container to every four gallons of cooling system capacity) into radiator, then fill system with water. Install pressure-type cap on radiator. Start engine and run it at fast idle to heat solution to at least 180° F. Use a cardboard to cover radiator if necessary, but do not allow coolant to boil. Continue to run engine at least 30 minutes. Stop engine, remove radiator cap, open radiator and engine block drain cocks, and allow system to drain completely.

(3) *Neutralize system.* Close radiator and crankcase drain cocks. Poor neutralizer (one container to every four gallons of cooling system capacity) into radiator, then fill system with water and install radiator cap. Start engine and run it at a fast idle, using radiator cover as necessary, to heat solution to at least 180°F. Continue to run engine at least 10 mintures. Stop engine, remove radiator cap, open radiator and engine cylinder block drain cocks, and allow system to drain completely.

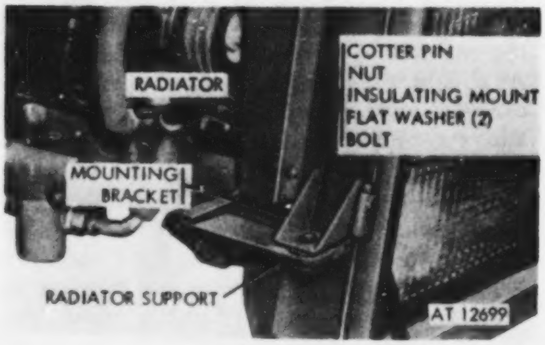


Figure 2-176. Radiator support and mounting bracket, right side.

(4) *Flush system.* Close radiator and engine block drain cocks. Fill system with clean fresh water (soft if possible); then install radiator cap. Start engine and run it at a fast idle, using radiator cover as necessary, to bring engine operating temperature to at least 180° F. Continue to run engine for at least 5 minutes. Remove radiator cap, open radiator and engine block drain cocks, and allow system to drain. If water is discolored to any extent, repeat this flushing operation.

***Caution.* Do not flush system by inserting a hose in the radiator with the engine running and the drain cocks open. This procedure will close thermostats and stop circulation of coolant through the engine.**

(5) *Clean radiator, cap, overflow tube, and drain cocks.* Clean cap by spraying a stream of water (hot if possible) through the holes in the valve cage while moving the pressure valve up and down with a blunt wooden instrument or a pencil. Clean out overflow pipe with a stream of water. Clean out dirt, trash, and insects imbedded in the air passages of the radiator, using compressed air or a low pressure stream of water; but do not use steam.

***Caution:* Do not hold air or water hose too close to the radiator or use too great pressure as damage to radiator may result. Clean out any stoppage in drain cocks with a soft wire.**

(6) *Fill system.* Close radiator and engine block drain cocks; then fill system to suit climatic conditions as follows: if above 32° F. partially fill the system with clean fresh water or coolant liquid (if available), and add a corrosion inhibitor; then fill with water until coolant level is visible in filler neck. If there is a possibility that temperatures below 32° F. will be encountered, fill system with equal parts of water and antifreeze solution MIL-O-A-548. For expected temperatures below −40° F. fill radiator with antifreeze solution MIL-C-11755 undiluted. Install radiator cap, start engine, and run at a fast idle until temperature gage shows normal operating temperature; then stop engine and check coolant level, adding coolant as necessary.

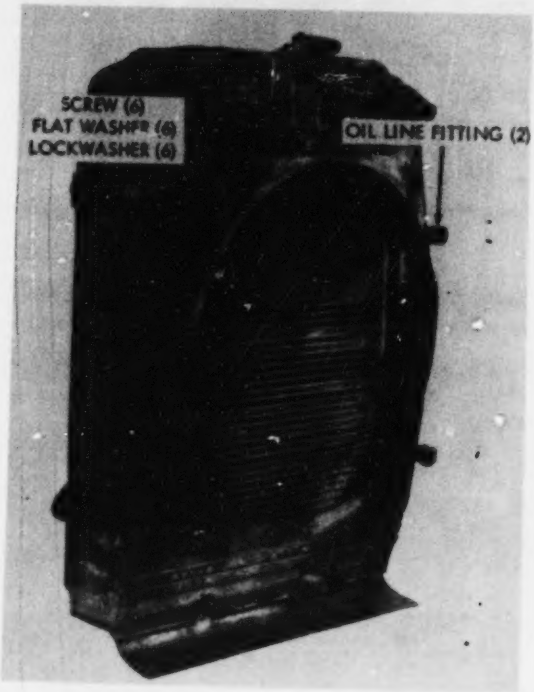


Figure 2-177. Radiator, oil cooler, and fan shroud assembly, reference view.

(7) *Rust preventives.* The cooling system must be free of rust and scale to maintain efficiency of the system. Use of inhibitors or rust preventives reduces or prevents formation of scale. Inhibitors are not cleaners and do not remove rust or scale already formed. Treating the cooling system with an inhibitor consists of adding an inhibitor to the coolant. The inhibitor should be renewed periodically, and especially if the system has been cleaned or flushed.

2-76. Radiator and Oil Cooler Assembly

a. Description. For a description of the radiator assembly refer to paragraph 2-35.

b. Removal.

(1) Remove engine hatch covers. Refer to paragraph 2-36.

(2) Remove two screws and flat washers

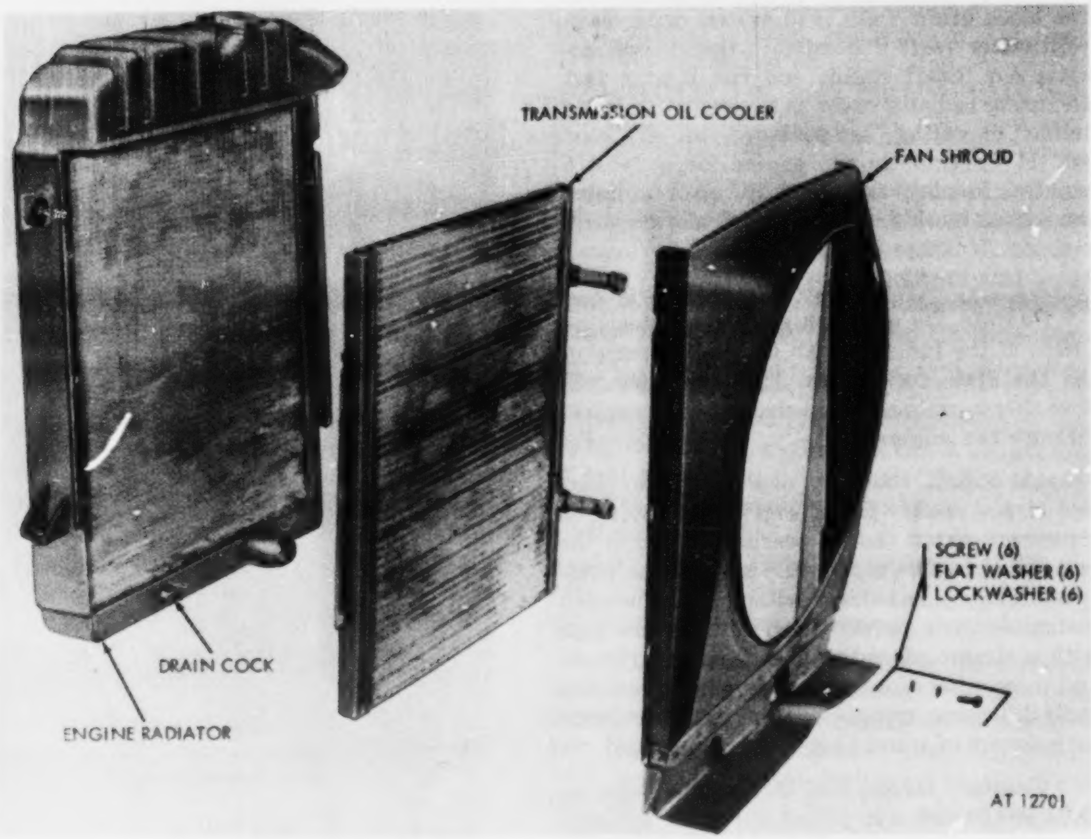


Figure 2-178. Engine radiator, transmission oil cooler and fan shroud.

securing brush guard to cab (fig. 2-172). Remove brush guard.

(3) Remove two nuts, four flat washers and two screws securing center windshield hinge lower half (fig. 2-173) to cab upper front crossmember.

(4) Flip hinge lower half upward and remove spacer (fig. 2-173) from under hinge.

Note. Windshield does not have to be removed from cab.

(5) Remove 10 screws, 10 flat washers, 2 flathead bolts and 2 nuts securing upper front crossmember to front of cab (fig. 2-174). Remove crossmember.

Note. If vehicle is equipped with winch, refer to paragraph 2-262, and disconnect drive shaft from winch input shaft. Secure drive shaft to engine upper bulkhead.

(6) Remove radiator cap and open radiator and engine drain cocks and drain coolant in suitable container.

Note. After radiator and engine have been drained, close drain cocks and install cap.

(7) Loosen clamps securing radiator inlet and outlet hoses to radiator (fig. 2-175). Disconnect hoses from radiator.

(8) Disconnect oil inlet and oil outlet lines from transmission oil cooler fittings (fig. 2-175).

Note. Catch oil drainage in suitable container. Plug oil lines and fitting openings to prevent entry of dust and dirt.

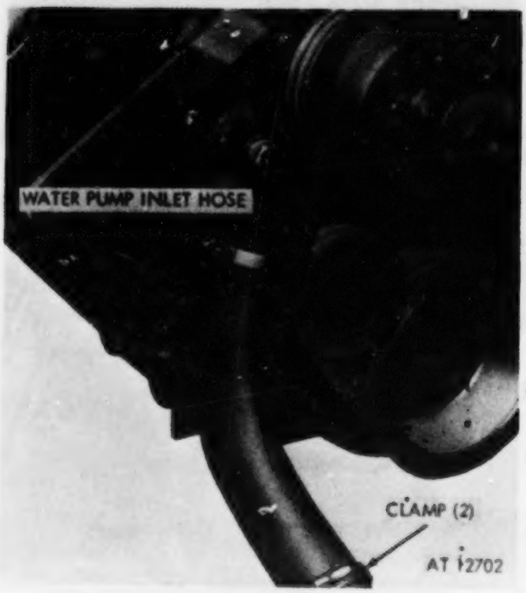


Figure 2-179. Water pump inlet hose.

(9) Remove two screws, lockwashers and nuts securing air inlet hose clamps to radiator shroud (fig. 2-174).

(10) Remove two cotter pins, nuts and bolts and four flat washers securing the two radiator mounting brackets to the engine and radiator support assembly (fig. 2-176).

(11) Remove two nuts and flat washers securing two radiator upper support rods to rubber insulating grommets at radiator (fig. 2-175).

(12) Tilt radiator, oil cooler and fan shroud assembly (fig. 2-177) forward and carefully lift upward and outward to remove radiator from vehicle.

(13) Remove six screws, lockwashers and flat washers securing fan shroud and transmission oil cooler to radiator (fig. 2-178). Carefully separate components.

c. Installation.

(1) Refer to removal procedures and reverse sequence.

Note. Dimension from front surface of transmission selector and radiator support bracket to rear surface of radiator bracket should be 10¾ inches to insure proper clearance for the engine fan.

(2) Fill transmission with oil and engine radiator with coolant. Refer to LO 9-2320-230-12. After engine has been started and obtains operating temperature and the transmission has been placed in gear ranges, recheck transmission oil and radiator coolant levels. Refill radiator and transmission as necessary.

Note. When installing cab front crossmember, apply adhesive on both cab and seal surfaces prior to assembly.

(3) If vehicle is equipped with winch, refer to paragraph 2-62 and connect drive shaft and input shaft.

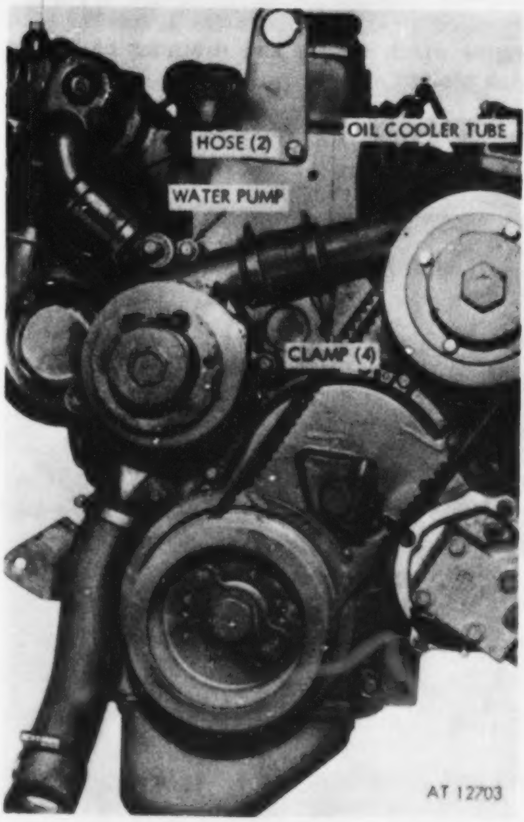


Figure 2-180. Water pump outlet hose and oil cooler tube hose.

(4) *Torque valves.*

Capscrews, shroud to radiator	6-8 lb-ft
Bolts, radiator base bracket to engine bracket	26-28 lb-ft
Screws, cab front crossmember	12-16 lb-ft
Bolts, cab front crossmember	22-26 lb-ft

2-77. Removal of Coolant Hoses and Water Inlet Tube

a. General. The cooling system components are connected by hoses and an inlet tube as follows: radiator-to-water pump inlet hose; water pump outlet-to-inlet tube hose; inlet tube; inlet tube-to-oil cooler hose, thermostat housing-to-water pump hose, and thermostat housing-to-radiator inlet hose. Removal of connecting hoses or inlet tube requires removal of the engine hatch covers and draining of the engine coolant system.

b. Water Pump Inlet Hose.

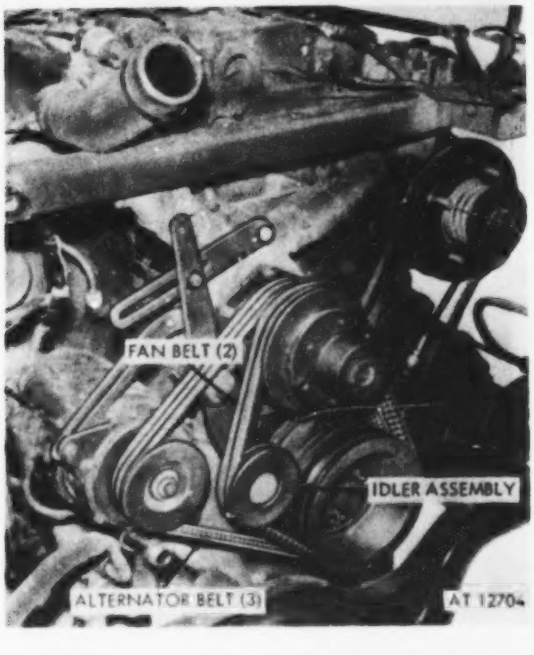


Figure 2-181. Engine fan belt idler assembly.

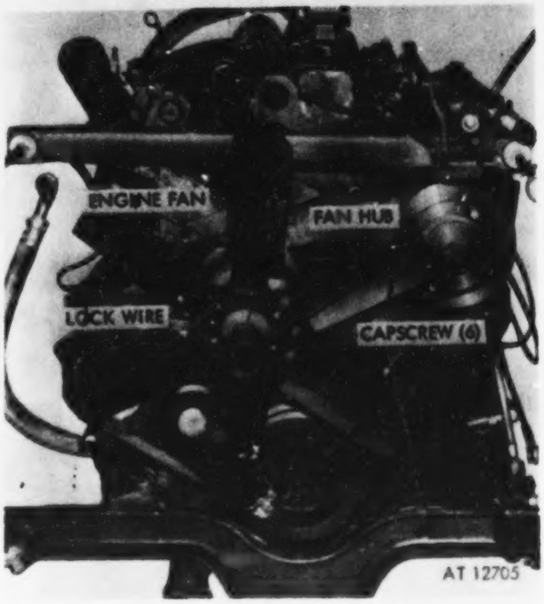


Figure 2-182. Engine fan mounting hub.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain cooolant in a clean, suitable container.

(4) Loosen hose clamp screws and slip clamps off hose (fig. 2-179).

(5) Twist hose to loosen and then slip hose off radiator outlet tube.

(6) Remove hose from water pump inlet neck.

c. Thermostat-To-Water Pump Hose.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain coolant in a clean, suitable container.

(4) Remove thermostat housing, refer to paragraph 2-83.

Note. Thermostat housing must be removed to remove the thermostat-to-water pump hose.

(5) Loosen clamp on water pump hose and remove hose (fig. 2-180).

d. Water Pump Outlet-To-Oil Cooler Tube Hose.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain coolant in clean, suitable container.

(4) Loosen hose clamp screws and slip clamps off hose (fig. 2-174).

(5) Twist hose to loosen and then slip hose rearward on oil cooler inlet tube.

(6) Raise water pump outlet tube and slip hose from tube.

e. Oil Cooler Inlet Hose.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain coolant in suitable container.

(4) Loosen hose clamp screws and slip clamps off hose.

(5) Twist hose to loosen and then slip hose forward on oil cooler inlet tube.

(6) Raise inlet tube and slip hose from oil cooler inlet tube.

f. Radiator Inlet Hose.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain coolant in a clean, suitable container.

(4) Loosen hose clamp screws and slip clamps off hose (fig. 2-174).

(5) Twist hose to loosen and then slip off radiator inlet neck.

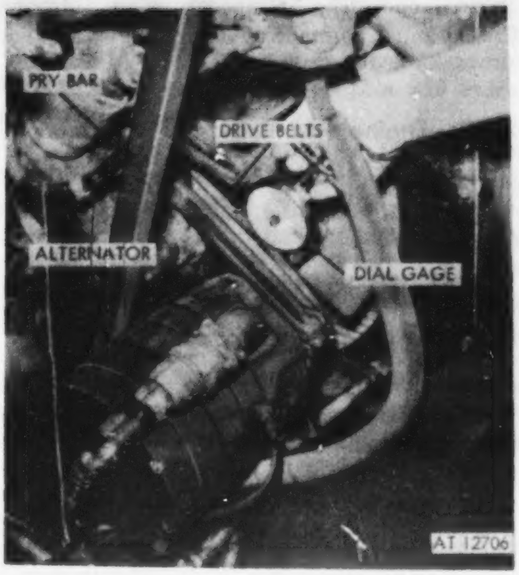


Figure 2-183. Checking drive belt tension using dial gage.

(6) Remove hose from thermostat housing outlet neck.

g. Oil Cooler Water Inlet Tube.

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove radiator cap.

(3) Open engine drain cock and radiator drain cock. Drain coolant in a clean, suitable container.

(4) Refer to *d* above and remove water pump-to-outlet tube hose.

(5) Loosen front hose clamp screw on the oil cooler water inlet hose.

(6) Remove oil cooler water inlet tube.

2-78. Installation of Coolant Hoses and Oil Cooler Water Inlet Tube

The coolant hoses and water inlet tube are installed in the reverse sequence of removal (para 2-77). After replacement of any hose(s) or the water inlet tube, the radiator must be filled to proper level with coolant (refer to LO 9-2320-230-12) and the engine operated until engine operating temperature is obtained. Checks must be made to determine if any coolant leaks are present.

2-79. Engine Fan Belt Idler Assembly

a. Removal (Fig. 2-181).

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Remove belt idler arm adjusting bolt, lockwasher, and flat washer. Force belt idler arm toward engine to loosen fan belts.

(3) Remove fan belts from idler pulley.

(4) Remove idler pivot bolt, lockwasher, flat washer, and spacer and remove belt idler assembly.

b. Installation. Refer to removal procedures and reverse sequence to install with the following exceptions.

(1) Adjust fan belt to proper tension, refer to paragraph 2-81*d*.

(2) Tighten idler arm pivot bolt and adjusting bolt to 116-129 lb-ft.

2-80. Engine Fan

a. Removal (Fig. 2-182).

(1) Remove radiator assembly, refer to paragraph 2-7*b*.

(2) Remove lock wire securing the fan mounting capscrews.

(3) Remove six capscrews mounting fan to hub and remove fan from hub.

b. Installation. Refer to removal procedures and reverse sequence to install using the following torque value.

Capscrew mounting fan ...... 20-25 lb-ft

2-81. Engine Belts

a. Fan Belt Removal (Fig. 2-181).

(1) Remove engine hatch covers, refer to paragraph 2-36.

(2) Loosen belt idler assembly adjusting bolt and move belt idler assembly arm toward engine to relieve belt tension on idler pulley.

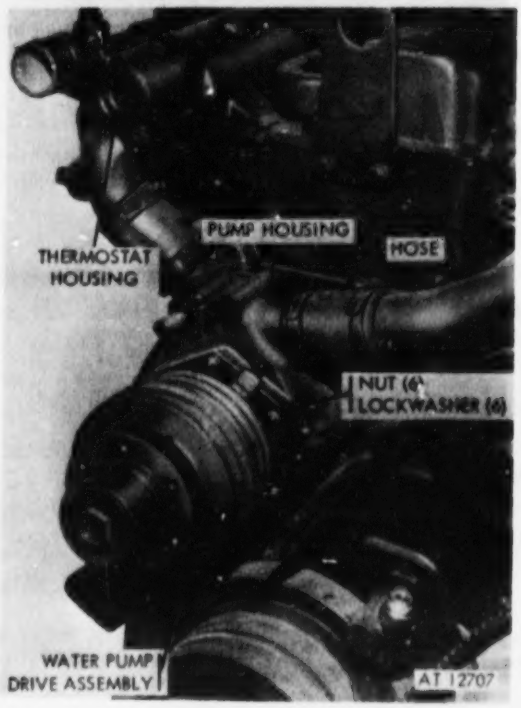


Figure 2-184. Engine water pump drive assembly and pump housing.

(3) Remove fan belts from idler pulley, and crankshaft pulley.

(4) Remove belts by lifting, one at a time, over and off fan assembly.

b. Alternator Belt Removal (Fig. 2-181).

(1) Loosen alternator adjusting bolt and two pivot bolts and move alternator toward engine to relieve tension on drive belts (fig. 2-181).

(2) Remove alternator belts from alternator pulley and crankshaft pulley.

(3) Remove belts by lifting belts, one at a time, over and off fan assembly.

c. Belt Installation.

(1) Refer to removal procedures and reverse sequence to install belts using the following torque values.

Alternator adjusting bolt ..	25-27 lb-ft
Idler arm adjusting bolt ..	116-129 lb-ft

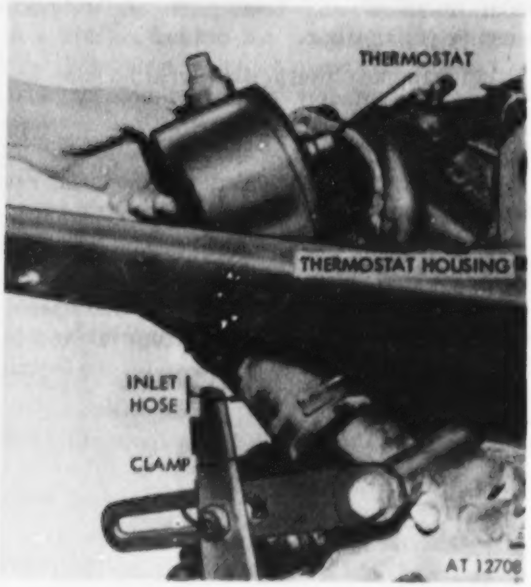


Figure 2–185. Engine thermostat.

Idler arm pivot bolt .... 116–129 lb-ft

Note. The two fan belts are a matched set and the three alternator belts are a matched set. Replacement of any one belt in a set requires the installation of a complete set.

(2) Refer to *d* below and adjust engine belts to proper tension.

d. Engine Belt Adjustment.

(1) *Fan drive belts (fig. 2–183).*

(*a*) Loosen idler adjusting bolt and shift belt idler pulley outward until tension on each of the fan belts is such that thumb pressure applied midway between fan pulleys and crankshaft pulley causes a maximum of 3/8–inch deflection. When using the belt tensio ndial gage, the dial reading should be 80–100.

(*b*) Tighten belt idler assembly adjusting bolt to 116–129 lb-ft and recheck fan belt tension to make sure that tension remains as specified in (*a*) above.

(2) *Alternator drive belts (fig. 2–181).*

(*a*) Loosen alternator adjusting bolt and pivot bolts.

(*b*) Place non-metallic pry bar between alternator front frame and crankcase.

***Caution:* Do not pry on alternator near the rectifier heat-sink area as this will cause damage to the alternator.**

(*c*) Pry alternator away from engine until tension on each of the belts is such that thumb pressure applied midway between alternator and water pump pulleys causes a maximum of 3/8-inch deflection. When using the tension dial gage, the dial reading should be 80–100.

(*d*) Tighten adjusting arm bolt to 116–129 lb-ft and recheck bolt tension to make sure that tension remains as specified in (*c*) above.

(*e*) Tighten pivot bolts to 116–129 lb-ft.

2–82. Engine Water Pump

a. Description. For a description of the watter pump, refer to paragraph 2–82.

b. Removal.

(1) Remove radiator assembly. Refer to paragraph 2–7*b*.

(2) Remove engine fan. Refer to paragraph 2–80*a*.

(3) Remove fan and alternator drive belts. Refer to paragraph 2–81.

(4) Remove six nuts and lockwashers securing water pump drive assembly to pump housing (fig. 2–194).

(5) Remove water pump drive assembly and gasket. Discard gasket.

c. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Tighten pump mounting nuts to 24–28 lb-ft.

2–83. Engine Thermostat

a. Description. For description of the engine thermostat, refer to paragraph 2–74*e*.

b. Removal.

(1) Remove engine hatch covers. Refer to paragraph 2–36.

(2) Open radiator and engine drain cocks and drain coolant from radiator and engine in suitable container. Close drain cocks after draining.

(3) Loosen two radiator inlet hose clamps and remove hose. Refer to figure 2-174.

(4) Loosen lower hose clamp on thermostat to water pump hose (fig. 2-184).

(5) Remove two bolts and lockwashers securing thermostat housing (fig. 2-184) to water jacket manifold of engine.

(6) Pull thermostat housing outward and upward, removing housing and thermostat from manifold and hose from water pump housing (fig. 2-185).

(7) Remove thermostat from housing and discard gasket.

c. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Tighten thermostat housing mounting bolts to 24-28 lb-ft.

(3) Fill radiator with coolant and operate engine. Check operation of thermostat and inspect housing and hose for leaks before installing engine hatch covers.

Section XVI. ALTERNATOR AND STARTER

2-84. General

a. This section contains the replacement and, where necessary, adjustment procedures for the engine alternator and starter assembly and relays.

b. Section VII, Electrical Troubleshooting, contains detailed information for locating and correcting malfunctions in the alternator and engine starter systems. The wiring diagrams give item names and identify the individual electrical leads by circuit numbers for each harness or cable assembly. Identification bands, secured to the leads, identify the wiring circuits.

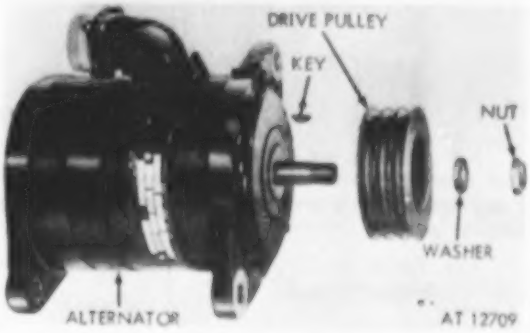


Figure 2-186. Alternator assembly.

2-85. Description

a. Alternator.

(1) The alternator (fig. 2-186) is mounted to the right front side of the engine. The mount of the alternator acts as a pivot to allow for adjustment of the alternator three drive belts which drive off a pulley mounted on the front of the engine crankshaft.

(2) The alternator system for the XM757 and XM791 trucks consists of a basic 30-ampere, 24-volt, negative-ground alternator having an internal voltage regulator and rectifier assembly.

(3) The M656 cargo truck uses the same

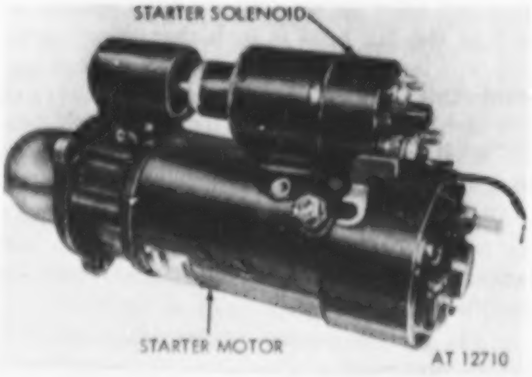


Figure 2-187. Starter motor and starter solenoid.

alternator, but has an auxiliary relay mounted on a bracket behind the transmission oil thermostat housing which changes the internal alternator circuitry to 80-amperes. This relay operates only when the bilge pumps are turned on. The alternator also has a pressurization line attached to the side of the alternator housing to prevent entry of water during swimming or fording operations.

b. Starter Assembly.

(1) The starter assembly consists of a starter solenoid and starter motor (fig. 2-187) having a clutch controlled drive gear that meshes with the engine flywheel ring gear to crank the engine. The 24-volt starter assembly is mounted to the right side of the engine flywheel housing.

(2) The starter solenoid operates the clutch of the starter motor drive gear and is mounted on the top side of the motor.

(3) A starter relay is connected in the electrical circuitry between the starter switch and starter solenoid. The relay is mounted in the channel of the vehicle right frame rail to the rear of the frame front crossmember.

Caution: **Before attempting replacement of, or repair on, the alternator or starter and their related components, the ground cable must be removed from the battery post and taped or secured to make sure no accidental contact will be made with the battery while work is being accomplished.**

2–86. Alternator

a. Removal.

(1) Remove front and rear engine hatch covers, refer to paragraph 2–36.

(2) Disconnect engine wiring ground cable and harness from alternator elbow connector (fig. 2–188 and fig. 2–189).

(3) Remove screw, lockwasher and flat washer securing adjusting bracket to alternator (fig. 2–188).

Note. On the M656 cargo truck, the pressurization line must be disconnected from alternator housing.

(4) Attach lifting sling to alternator housing and mounting bracket.

(5) Loosen two nuts securing alternator to mounting bracket (fig. 2–189). Move alternator towards engine block and lift off three drive belts from alternator drive pulley (fig. 2–190).

(6) Remove three capscrews and lockwashers securing mounting bracket to engine and remove alternator with mounting bracket.

(7) Remove two nuts, lockwashers, and bolts securing mounting bracket to alternator and remove mounting bracket.

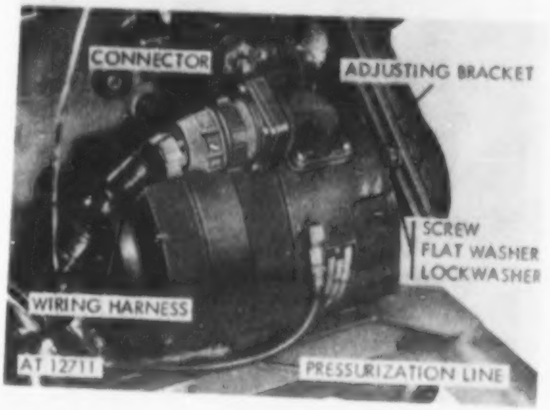


Figure 2–188. Alternator, mounted view.

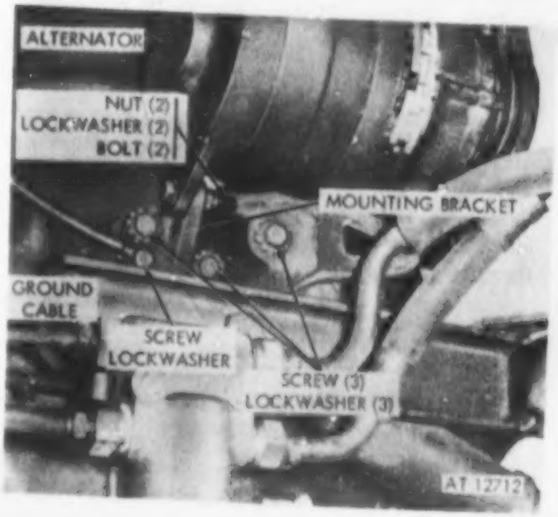


Figure 2–189. Alternator mounting bracket.

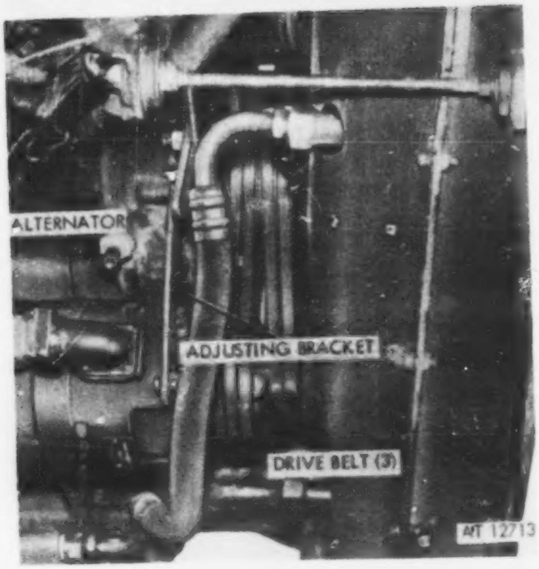

ALTERNATOR
ADJUSTING BRACKET
DRIVE BELT (3)
AT 12713

Figure 2-190. Alternator drive belts.

(8) Remove nut, flat washer and woodruff key from alternator drive shaft and use puller to remove pulley from alternator.

b. Installation.

(1) Install pulley on alternator drive shaft and secure with woodruff key, flat washer, and nut. Tighten nut to 70–80 lb-ft.

(2) Position alternator on mounting bracket and install two bolts, lockwashers, and nuts. Do not tighten nuts.

(3) Use lifting sling to position alternator and mounting bracket on engine and secure mounting bracket with three capscrews and lockwashers. Tighten capscrews to 40–48 lb-ft. Remove lifting sling.

(4) Position drive belts on alternator pulley.

(5) Position adjusting bracket to alternator and install capscrew, lockwasher, and flat washer. Do not tighten capscrew.

(6) Place belt tension gage on rear alternator drive belt and use a non-metallic pry bar between alternator housing and engine block to pry alternator outward from engine until gage

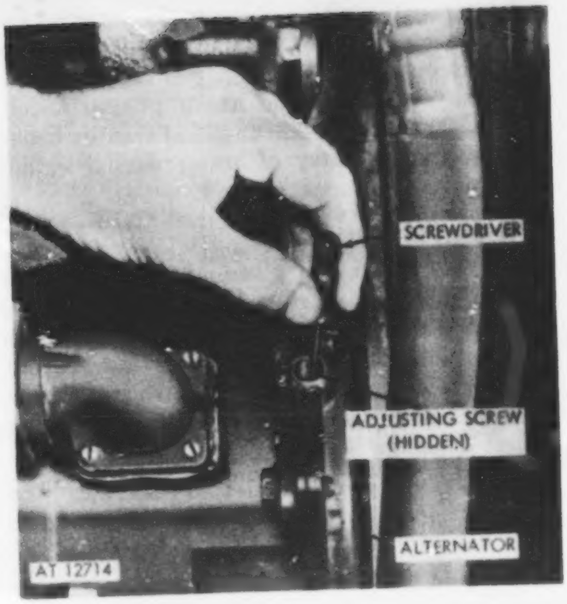

SCREWDRIVER
ADJUSTING SCREW (HIDDEN)
ALTERNATOR
AT 12714

Figure 2-191. Adjusting alternator voltage output.

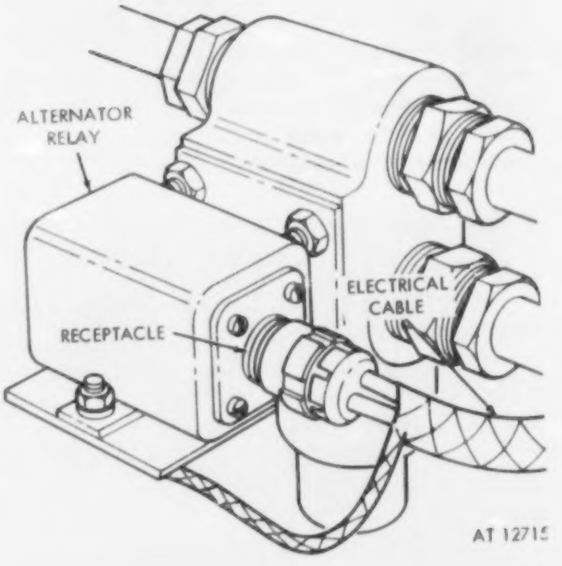

ALTERNATOR RELAY
ELECTRICAL CABLE
RECEPTACLE
AT 12715

Figure 2-192. Alternator relay.

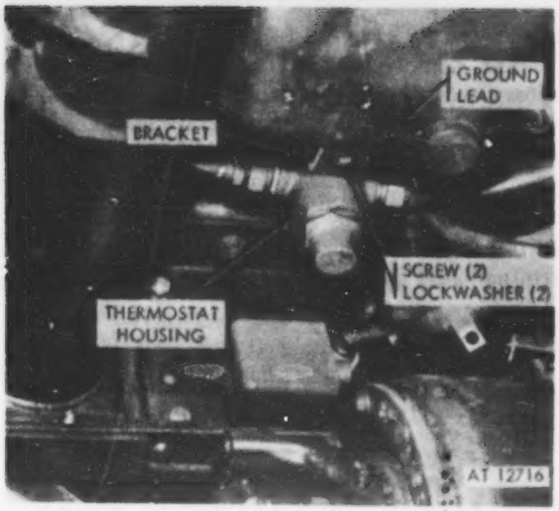

GROUND LEAD
BRACKET
SCREW (2)
LOCKWASHER (2)
THERMOSTAT HOUSING
AT 12716

Figure 2–193. Alternator relay, mounted view.

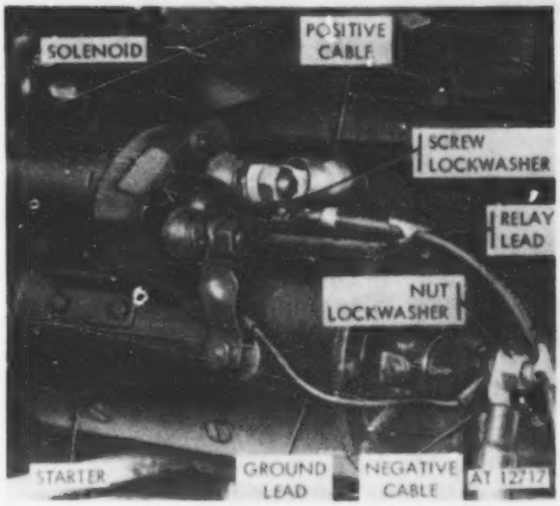

SOLENOID
POSITIVE CABLE
SCREW
LOCKWASHER
RELAY LEAD
NUT
LOCKWASHER
STARTER
GROUND LEAD
NEGATIVE CABLE
AT 12717

Figure 2–194. Starter motor, solenoid and electrical cables.

reads 80–100 lbs. While holding alternator in this position, tighten adjusting bracket capscrews to 25–27 lb-ft. Remove belt tension gage.

Note. To check belt tension without using tension gage, apply thumb pressure to belts midway between pulleys. Maximum deflection should be ⅜ inch.

(7) Tighten two mounting bolt nuts that secure alternator to mounting bracket.

(8) Connect engine wiring harness to alternator connector.

(9) Connect engine ground lead.

Note. On M656 cargo truck, connect pressurization line to alternator housing.

(10) Install engine hatch covers.

2–87. Alternator Drive Belts

a. Refer to paragraph 2–86*b* to remove and install the alternator drive belts.

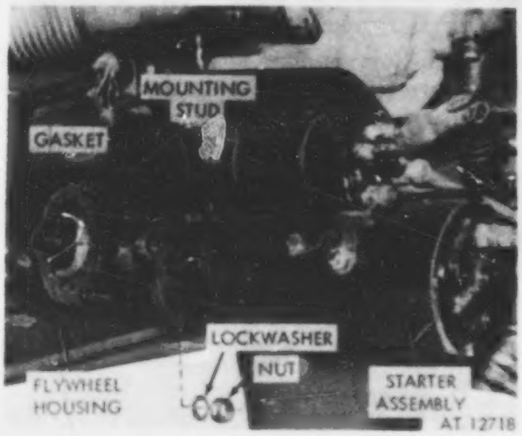

MOUNTING STUD
GASKET
LOCKWASHER
NUT
FLYWHEEL HOUSING
STARTER ASSEMBLY
AT 12718

Figure 2–195. Starter assembly, mounting studs and gasket.

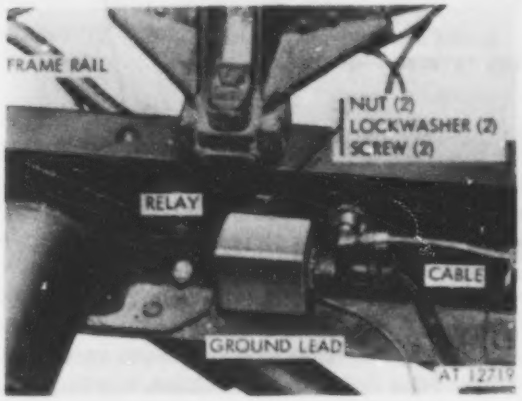

FRAME RAIL
NUT (2)
LOCKWASHER (2)
SCREW (2)
RELAY
CABLE
GROUND LEAD
AT 12719

Figure 2–196. Starter relay.

b. Refer to paragraph 2-86*b* above for adjustment of the alternator drive belts.

2-88. Alternator Voltage Adjustment

a. General. Refer to the procedures and instructions given in Section VII, Electrical Troubleshooting, check output voltage of the alternator. If voltage output is above 29 or below 27, the alternator voltage control must be adjusted.

b. Procedures.

(1) Remove engine hatch covers, refer to paragraph 2-86.

(2) Remove adjusting screw plug.

(3) Start engine and operator at 1000 rpm. Turn screw (fig. 2-191) until proper voltage output of the alternator is obtained.

Note. Turning screw clockwise increases the voltage output, counterclockwise decreases output voltage.

(4) After proper voltage output has been abtained, replace adjusting screw plug.

(5) Install engine hatch covers, refer to figure 2-92.

2-89. Alternator Relay, M656

a. Removal.

(1) Disconnect the electrical cable from receptacle of alternator relay (fig. 2-192).

(2) Remove two screws and lockwashers securing relay and ground lead to bracket located on rear side of transmission oil cooler thermostat housing (fig. 2-193). Remove relay.

b. Installation. Refer to removal procedures and reverse sequence.

2-90. Starter and Solenoid

a. Removal.

(1) Remove nut and lockwasher securing battery negative cable and solenoid ground lead to terminal post on starter motor end plate (fig. 2-194). Remove cables and lead from post.

(2) Remove nut and lockwasher securing positive cable and harness lead cable to large terminal post on solenoid (fig. 2-194).

(3) Remove screw and lockwasher securing relay lead to solenoid (fig. 2-194).

(4) Remove three nuts and lockwashers securing starter assembly to engine flywheel housing (fig 2-195).

(5) Use jack or other means to support starter while pulling starter assembly straight forward off mounting studs and out of flywheel housing (fig. 2-195).

(6) Remove starter assembly and discard gasket (fig. 2-195).

b. Installation. Use new gasket and refer to removal procedures and reverse sequence.

2-91. Starter Relay

a. Removal.

(1) Disconnect electrical cable from receptacle of relay (fig. 2-196).

(2) Remove two screws, lockwashers and nuts securing relay and ground lead to right frame rail. Remove relay.

b. Installation. Refer to removal procedures and reverse sequence.

Section XVII. INSTRUMENT PANEL CLUSTER, SWITCHES, INDICATORS, AND LIGHTS

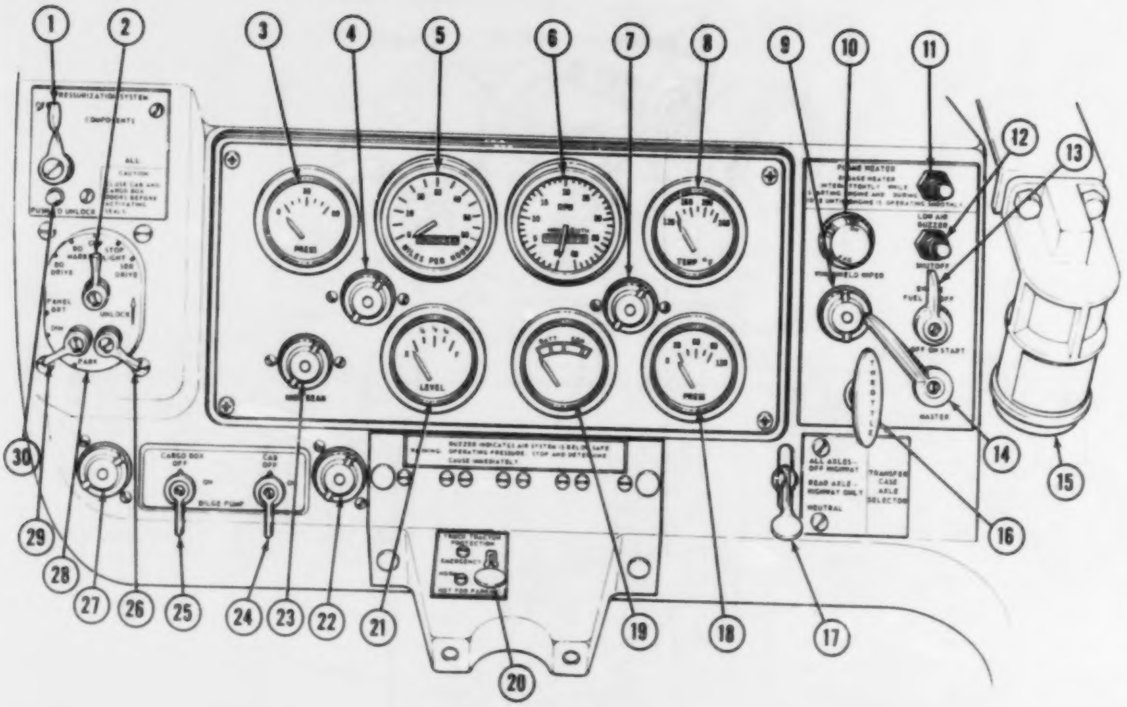
2-92. General

This section contains replacement procedures for the instrument panel cluster, switches, indicators, and lights. Except where specifically noted, items listed in this section are generally applicable to all vehicles covered in this manual.

***Warning:* Before attempting any maintenance-type operation on instrument panel, make sure the master switch is in "OFF" position and battery ground (negative) cable is disconnected from batteries.**

2-93. Instrument Cluster

a. Description. The instrument panel cluster (fig. 2-197) is held onto the instrument panel


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
PRESS
MILES PER HOUR
RPM
TEMP °C
LEVEL
PRESS
HIGH BEAM
PARK
UNLOCK
BILGE PUMP
CARGO BOX OFF
CAB OFF
THROTTLE
MASTER
SHUTOFF
TRANSFER CASE AXLE SELECTOR
ALL AXLES
REAR AXLE
NEUTRAL

AT 12720

1—Pressurization system control lever
2—Driving lights switch
3—Engine oil pressure gage
4—Instrument panel lamp
5—Speedometer and odometer
6—Tachometer and hour meter
7—Instrument panel lamp
8—Engine coolant temperature gage
9—Transmission temperature indicator
10—Windshield wiper variable control
11—Flame heater switch
12—Low air buzzer shutoff
13—Engine fuel cutoff switch
14—Master switch
15—Air filter indicator
16—Throttle control
17—Transfer case axle selector lever
18—Air pressure gage
19—Battery-generator indicator
20—Truck tractor protection valve control lever
21—Fuel level gage
22—Bilge pump indicator (cab) (M656 only)
23—High beam indicator
24—Bilge pump switch (cab) (M656 only)
24—Fuel tank selector switch (XM757 only)
25—Bilge pump switch (cargo box) (M656 only)
26—Unlock switch lever
27—Bilge pump indicator (cargo box) (M656 only)
28—Vehicle lighting control switch
29—Auxiliary lights switch
30—Press to unlock switch button

Figure 2-197. Instrument panel (typical).

by four mounting screws and contains the battery-generator indicator, fuel level gage, engine coolant temperature gage, oil pressure gage, air pressure gage, speedometer with odometer, tachometer with hour meter, two instrument panel lights, and a headlight high beam indicator. The instruments are secured to the cluster by nuts and the lights and indicators are secured by screws. Electrical connections are through cable connectors. A flexible shaft from drive on transfer case and through a coupling mounted on cab floorboard connects to speedometer. A flexible shaft from an angle drive joint at front of camshaft and through a coupling mounted on engine left bulkhead connects to the tachometer. The instrument cluster lights are controlled by the main light switch. The headlight high beam indicator is controlled by the headlight beam selector switch mounted on cab floorboard.

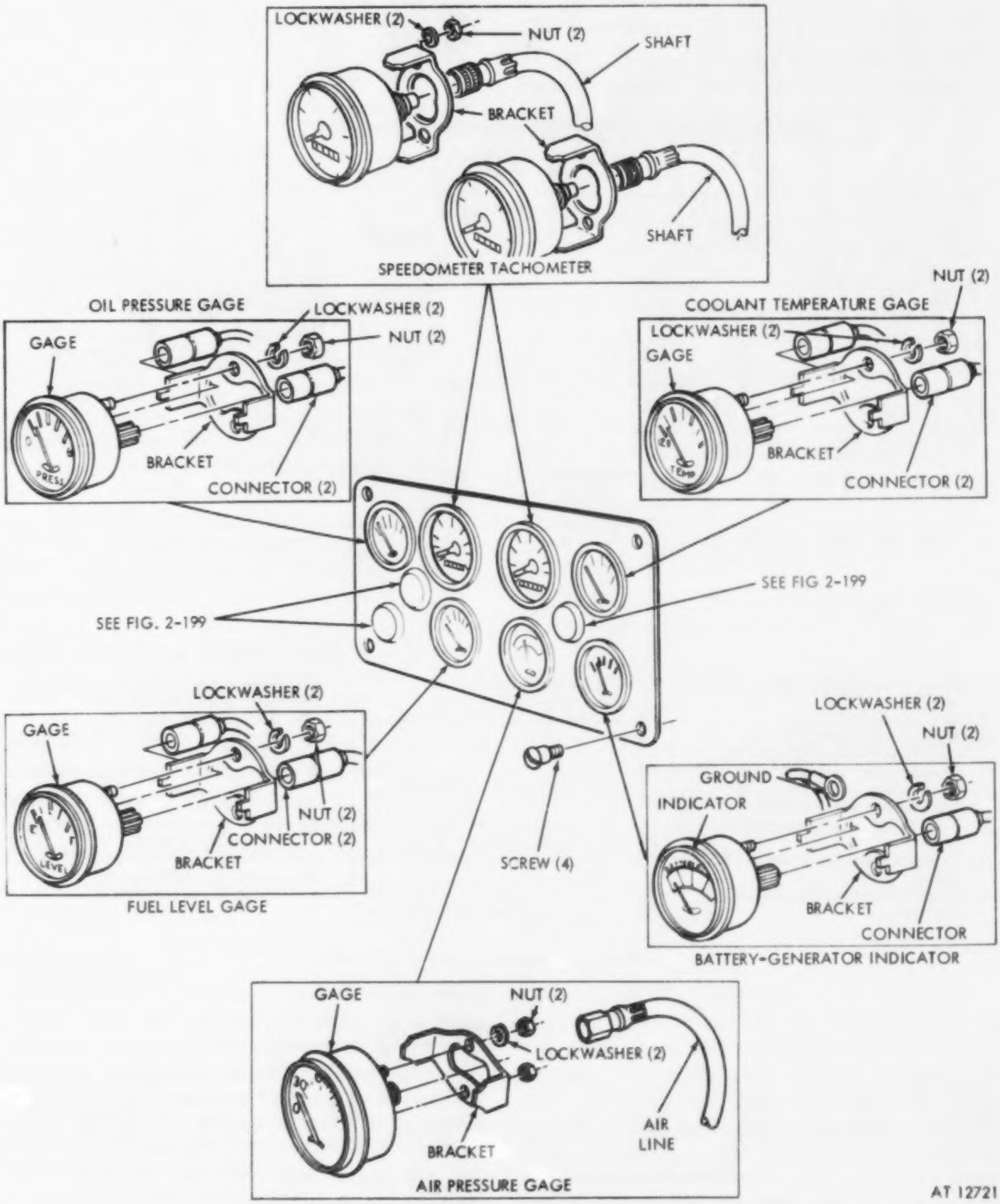

LOCKWASHER (2)
NUT (2)
SHAFT
BRACKET
SHAFT
SPEEDOMETER TACHOMETER
OIL PRESSURE GAGE
GAGE
LOCKWASHER (2)
NUT (2)
BRACKET
CONNECTOR (2)
NUT (2)
COOLANT TEMPERATURE GAGE
LOCKWASHER (2)
GAGE
BRACKET
CONNECTOR (2)
SEE FIG. 2-199
SEE FIG 2-199
LOCKWASHER (2)
GAGE
NUT (2)
CONNECTOR (2)
BRACKET
FUEL LEVEL GAGE
SCREW (4)
LOCKWASHER (2)
NUT (2)
GROUND
INDICATOR
BRACKET
CONNECTOR
BATTERY-GENERATOR INDICATOR
GAGE
NUT (2)
LOCKWASHER (2)
BRACKET
AIR LINE
AIR PRESSURE GAGE
AT 12721

Figure 2-198. Instrument cluster and components.

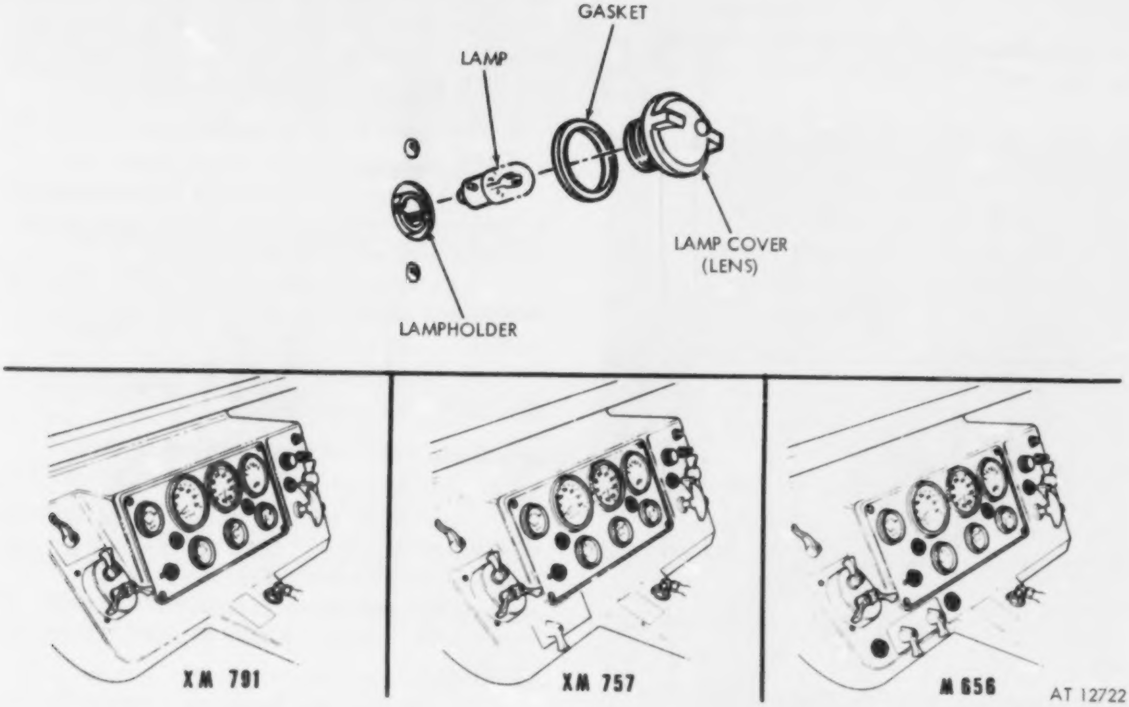


Figure 2-199. Instrument panel lights and indicators.

b. Removal.

(1) Disconnect speedometer and tachometer cables at floor and sidewall coupling.

(2) Remove four cluster mounting screws (fig. 2-198) and pull cluster away from instrument panel.

Note. Replacement of any individual gage, light, or indicator may be made with cluster in this position.

(3) Release air from air system (para 2-169*b*) and disconnect air line from rear of air pressure gage.

(4) Disconnect all electrical connectors from instrument and indicator or light terminals.

(5) Remove instrument cluster.

c. Installation. Refer to removal procedure and reverse sequence. Tighten mounting screws to 4-5 lb-in.

2-94. Instrument Cluster Components

a. General.

(1) It is not necessary to remove instrument cluster from instrument panel to replace individual gages, lights, or indicators. Refer to paragraph 2-93*b* and pull cluster away from instrument panel to replace any component.

(2) The battery-generator, fuel level gage, oil pressure gage, and engine coolant temperature gage, are all replaced in the same manner. The air-type air pressure gage has an air line connection instead of an electrical connector. Disconnect the air line at the gage, when the instrument or cluster is removed. The speedometer and tachometer have flexible shaft connectors instead of electrical connectors. All light-type indicators and lights are also replaced in the same manner.

(3) Refer to TB ORD 479 for a list of standard replacement instruments which may

be used to replace defective or damaged instruments.

(4) Most instruments automatically return to zero when the master switch is turned off. Some instruments remain at the readings indicated when the master switch is turned off. These instruments are not defective. Refer to TB ORD 434 for a complete explanation.

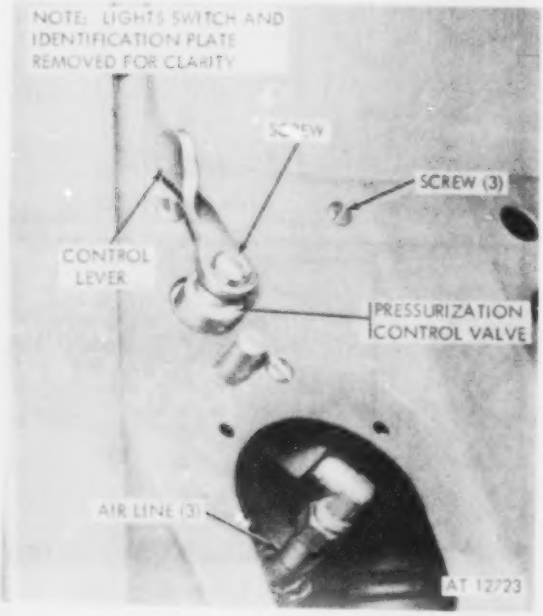

NOTE: LIGHTS SWITCH AND IDENTIFICATION PLATE REMOVED FOR CLARITY
SCREW
SCREW (3)
CONTROL LEVER
PRESSURIZATION CONTROL VALVE
AIR LINE (3)
AT 12723

Figure 2-200. Pressurization control valve (switch) (M656), removal and installation.

b. Speedometer (Fig. 2-198).

(1) *Removal.*

(*a*) Place hand on front of speedometer to prevent instrument from falling and remove two nuts, lockwashers, and bracket.

(*b*) Remove speedometer from front of instrument cluster. Remove shaft from speedometer.

(2) *Installation.* Refer to removal procedure and reverse sequence.

c. Tachometer (Fig. 2-198).

(1) *Removal.*

(*a*) Place hand in front of tachometer to prevent instrument from falling and remove two nuts, lockwashers, and bracket.

(*b*) Remove tachometer from front of instrument cluster. Remove shaft from tachometer.

(2) *Installation.* Refer to removal procedure and reverse sequence.

d. Oil Pressure Gage (Fig. 2-198).

(1) *Removal.*

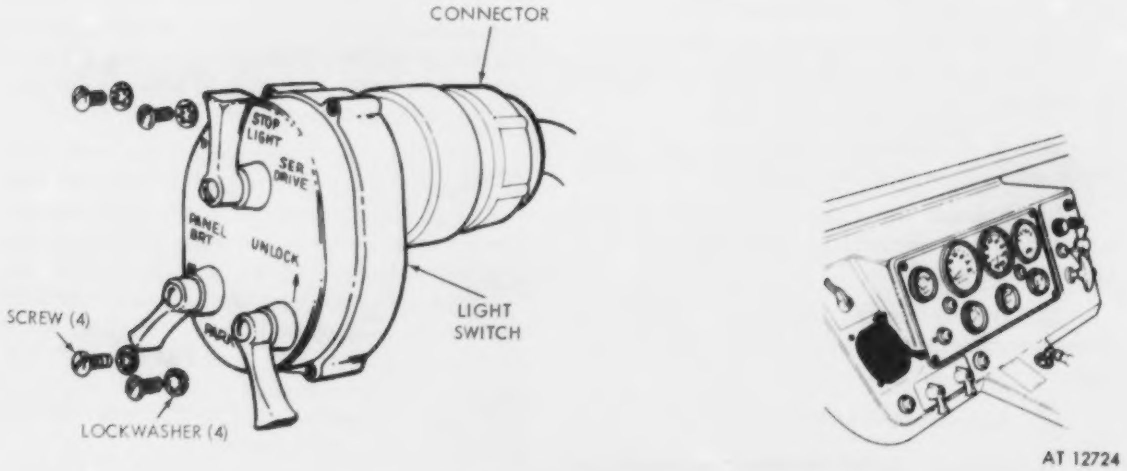

CONNECTOR
STOP LIGHT
SER DRIVE
PANEL BRT
UNLOCK
PARK
SCREW (4)
LOCKWASHER (4)
LIGHT SWITCH
AT 12724

Figure 2-201. Lights switch, removal and installation.

(*a*) Disconnect two electrical connectors (circuits 27A and 36) from rear of gage.

(*b*) Place hand in front of gage to prevent gage from falling and remove two nuts, lockwashers, and bracket.

(*c*) Remove oil pressure gage from front of instrument cluster.

(2) *Installation.* Refer to removal procedure and reverse sequence.

e. Battery-Generator Indicator (*Fig 2–198*).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 27) from rear of indicator.

(*b*) Remove nut and lockwasher and remove ground wire (circuit 57) from mounting stud.

(*c*) Place hand in front of indicator to prevent indicator from falling and remove remaining nut, lockwasher, and bracket.

(*d*) Remove battery-generator indicator from front of instrument cluster.

(2) *Installation.* Refer to removal procedure and reverse sequence.

f. Engine Coolant Temperature Gage (*Fig. 2–198*).

(1) *Removal.*

(*a*) Disconnect two electrical connectors (circuits 27A and 33) from rear of gage.

(*b*) Place hand in front of gage to prevent gage from falling and remove two nuts, lockwashers, and bracket.

(*c*) Remove engine coolant temperature gage from front of instrument cluster.

(2) *Installation.* Refer to removal procedure and reverse sequence.

g. Fuel Level Gage (*Fig. 2–198*).

(1) *Removal.*

(*a*) Disconnect two electrical connectors (circuits 27A and 28) from rear of gage.

(*b*) Place hand in front of gage to prevent gage from falling and remove two nuts, lockwashers and bracket.

(*c*) Remove fuel level gage from front of instrument cluster.

(2) *Installation.* Refer to removal procedure and reverse sequence.

h. Air Pressure Gage (*Fig. 2–198*).

(1) *Removal.*

(*a*) Release air from air system (para 2–169*b*) and disconnect air line from rear of gage.

(*b*) Place hand in front of gage to prevent gage from falling and remove two nuts, lockwashers, and bracket.

(*c*) Remove air pressure gage from front of instrument cluster.

(2) *Installation.* Refer to removal procedure and reverse sequence.

i. Instrument Cluster Lights (*Fig. 2–199*).

(1) *Removal.*

(*a*) Remove lamp cover (lens) and gasket.

(*b*) Remove lamp from lampholder.

(2) *Installation.* Refer to removal procedure and reverse sequence.

j. Bilge Pump Indicators (*M656*) *and Headlight High Beam Indicator* (*Fig. 2–199*). Refer to *i* above.

2–95. Instrument Panel Switches and Controls

a. Pressurization Control Valve (*Switch*) (*M656*) (*Fig. 2–200*).

(1) *Removal.*

(*a*) Release air from air system (para 2–169*b*) and disconnect three air lines from rear of control valve.

(*b*) Remove retaining screw from center of control lever and remove lever.

(*c*) Remove three screws from front of instrument panel and remove control valve from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Pressurization Control Value (*Switch*) (*XM757 and XM791*). The removal and installation procedures for XM757 and XM791 are similar to M656 in *a* above, the only difference being that there are only two air lines at rear of switch.

c. Light Switch (*Fig. 2–201*).

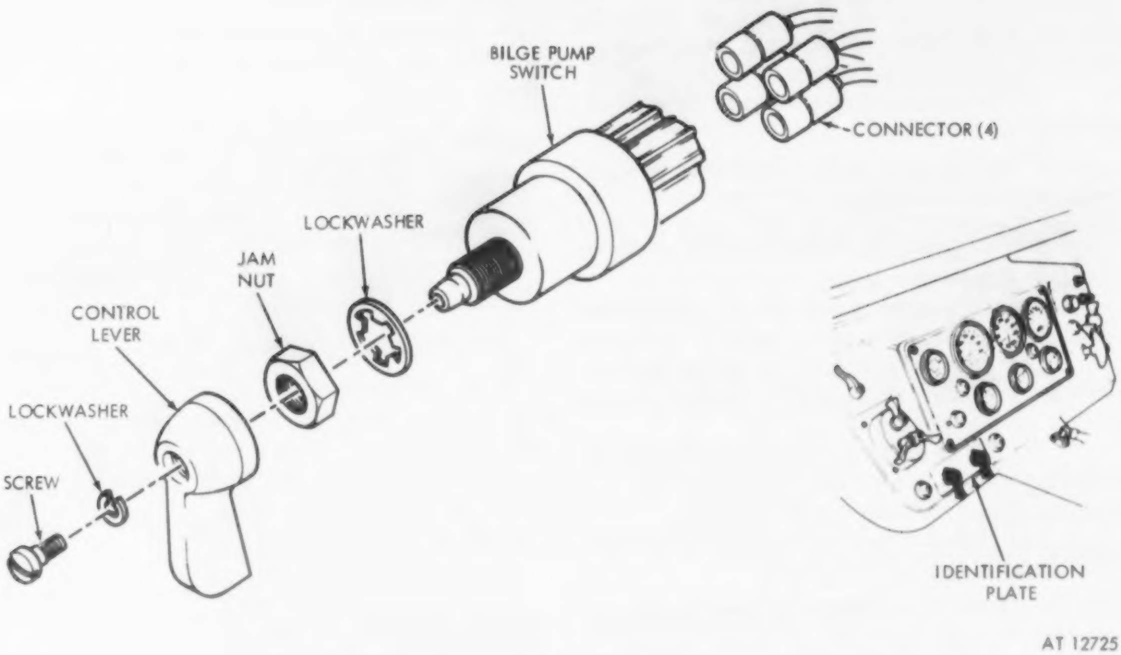


Figure 2-202. Bilge pump switches, removal and installation.

(1) *Removal.*

(*a*) Remove four retaining screws and lockwashers securing light switch to instrument panel.

(*b*) Remove light switch from rear of instrument panel.

(*c*) Disconnect electrical cable from rear of light switch.

(2) *Installation.* Refer to removal procedure and reverse sequence.

d. Bilge Pump Switches (M656) (Fig. 2-202).

(1) *Removal.*

(*a*) Disconnect eight electrical connectors (circuits 451, 451F, 451R, 452, 452L, and 452R) from rear of bilge pump switches (four from each switch).

(*b*) Remove screw and lockwasher from center of each bilge pump switch control lever and remove control levers.

(*c*) Remove jamnut and lockwasher from each bilge pump switch.

(*d*) Remove identification plate from front of instrument panel and bilge pump switch from rear.

(2) *Installation.* Refer to removal procedure and reverse sequence.

e. Fuel Tank Selector Switch (XM757) (Fig. 2-203).

(1) *Removal.*

(*a*) Disconnect three electrical connectors (circuits 76, 77, and 78) from rear of fuel tank selector switch.

(*b*) Remove screw and lockwasher from center of fuel tank selector switch control lever and remove control lever.

(*c*) Remove jamnut and lockwasher from fuel tank selector switch.

(*d*) Remove identification plate from front of instrument panel and fuel tank selector switch from the rear.

(2) *Installation.* Refer to removal procedure and reverse sequence.

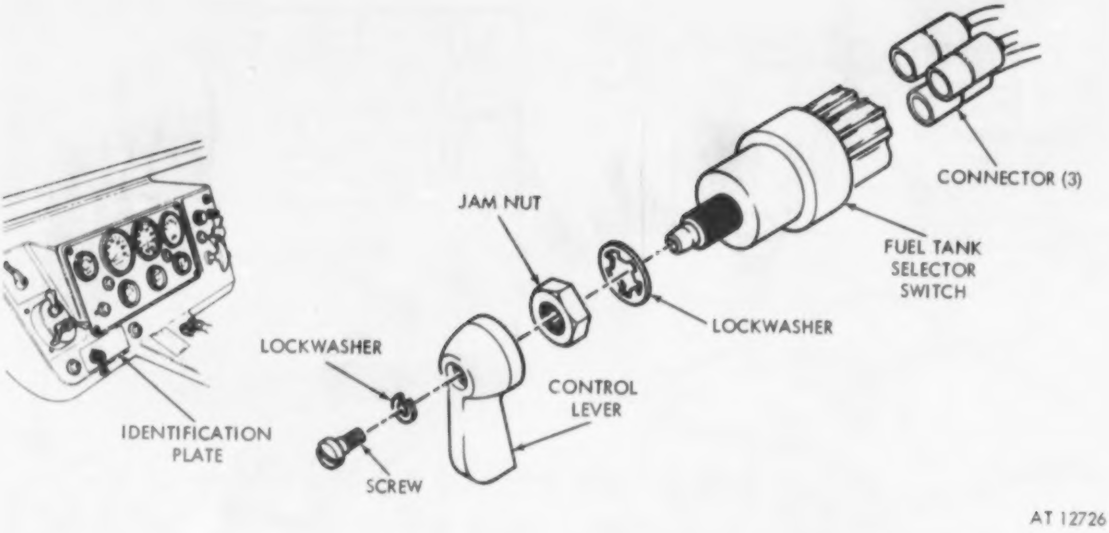


Figure 2-203. Fuel tank selector switch, removal and installation.

f. Truck-Tractor Protection Control Valve (Switch) (Fig. 2-204).

(1) *Removal.*

(*a*) Release air from air system (para 2-169*b*) and disconnect two air lines from rear of truck-tractor protection switch.

(*b*) Remove two screws and lockwashers securing identification plate and truck-tractor protection control valve to instrument panel.

(*c*) Tilt switch sideways and remove truck protection control valve from rear of instrument panel and identification plate from front.

(2) *Installation.* Refer to removal procedure and reverse sequence.

g. Transfer Case Axle Selector (Fig. 2-205).

(1) *Removal.*

(*a*) Release air from air system (para 2-169*b*) and disconnect two air lines from rear of transfer case axle selector.

(*b*) Remove two screws and lockwashers securing identification plate and transfer case axle selector to instrument panel.

(*c*) Remove identification plate from front of instrument panel. Tilt transfer case axle selector sideways and remove selector from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

h. Throttle Control (Fig. 2-206).

(1) *Removal.*

(*a*) Loosen setscrew on stop that secures cable to throttle control arm and remove stop.

(*b*) Remove screw and nut retaining cable in bracket.

(*c*) Remove nut, flat washer, and lockwasher from throttle control at rear of instrument panel.

(*d*) Remove throttle control by pulling control and cable through front of instrument panel.

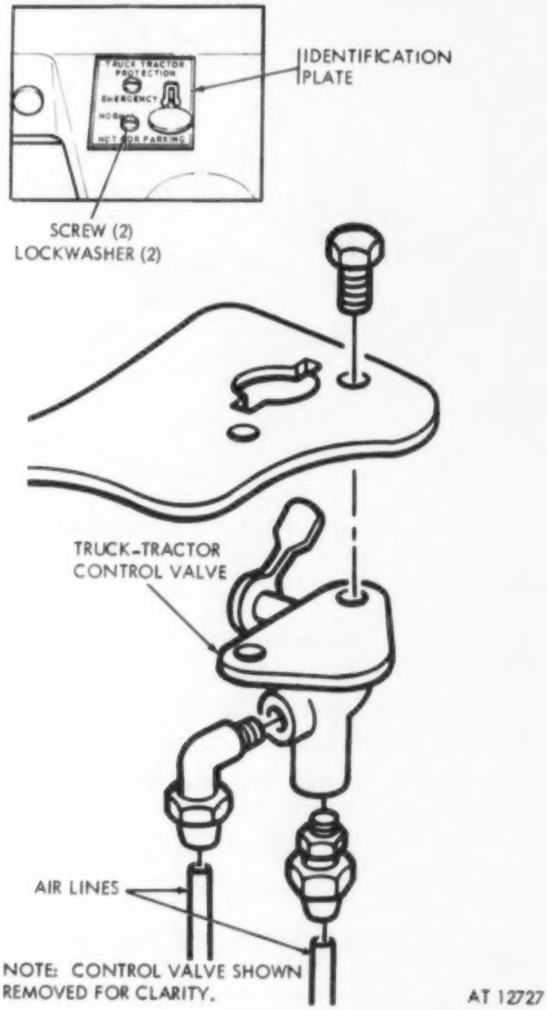
(2) *Installation.* Refer to removal procedure and reverse sequence.

i. Master Switch (Fig. 2-207).

(1) *Removal.*

(*a*) Disconnect three electrical connectors (circuits 11, 14A, and 27) from rear of master switch.

(*b*) Remove screw and lockwasher


TRUCK TRACTOR PROTECTION
EMERGENCY
NORMAL
NOT FOR PARKING
IDENTIFICATION PLATE
SCREW (2)
LOCKWASHER (2)
TRUCK-TRACTOR CONTROL VALVE
AIR LINES

NOTE: CONTROL VALVE SHOWN REMOVED FOR CLARITY.

AT 12727

Figure 2–204. Truck-tractor protection control valve (switch), removal and installation.

from center of master switch control lever and remove lever.

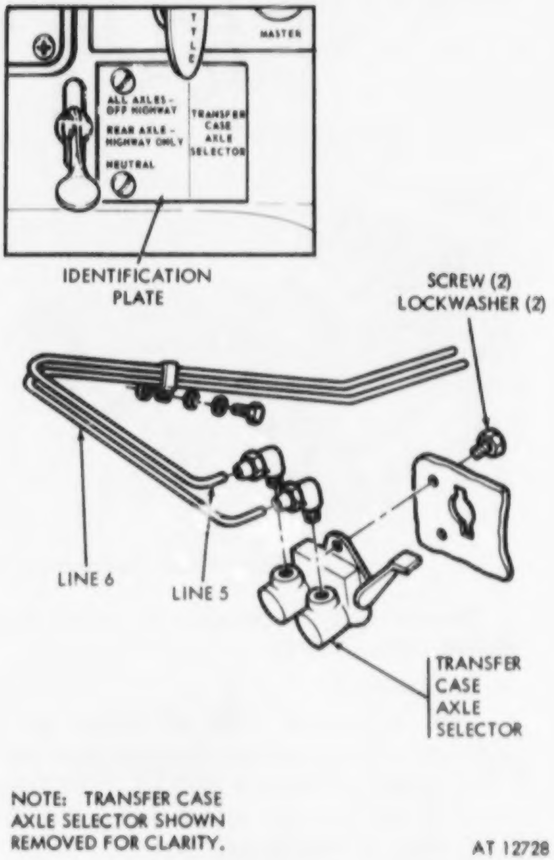
(*c*) Remove jamnut and lockwasher securing master switch to instrument panel.

(*d*) Remove master switch from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

j. Engine Fuel Cutoff Switch (*fig. 2–207*).

(1) *Removal.*


MASTER
ALL AXLES - OFF HIGHWAY
REAR AXLE - HIGHWAY ONLY
NEUTRAL
TRANSFER CASE AXLE SELECTOR
IDENTIFICATION PLATE
SCREW (2)
LOCKWASHER (2)
LINE 6
LINE 5
TRANSFER CASE AXLE SELECTOR

NOTE: TRANSFER CASE AXLE SELECTOR SHOWN REMOVED FOR CLARITY.

AT 12728

Figure 2–205. Transfer case axle (selector), removal and installation.

(*a*) Disconnect two electrical connectors (circuit 54) from rear of engine fuel cutoff switch.

(*b*) Remove screw and lockwasher from center of engine fuel cutoff switch control lever and remove lever.

(*c*) Remove jamnut and flat washer securing engine fuel cutoff switch to instrument panel.

(*d*) Remove engine fuel cutoff switch from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

k. Low Air Pressure Warning Indicator (Buzzer) Shutoff Switch (*Fig. 2–207*).

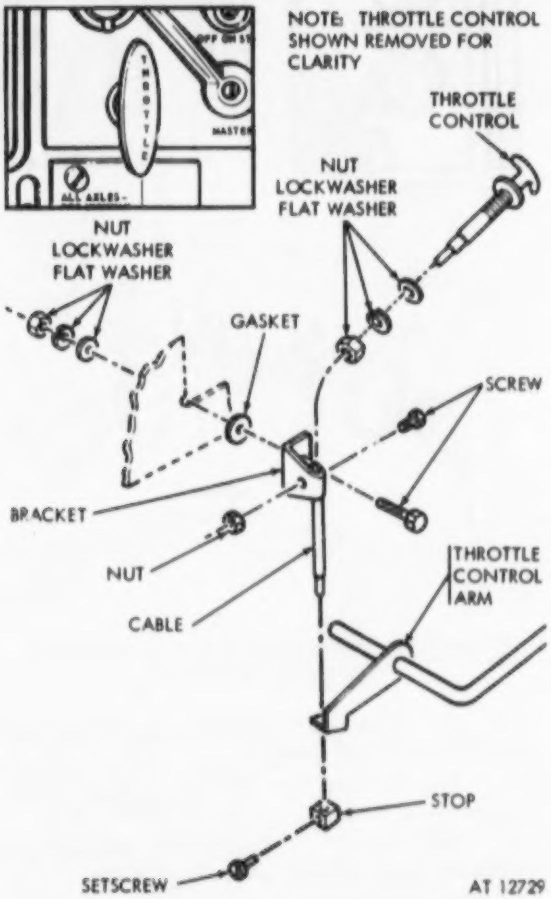

NOTE: THROTTLE CONTROL SHOWN REMOVED FOR CLARITY
THROTTLE
MASTER
ALL AXLES-
THROTTLE CONTROL
NUT
LOCKWASHER
FLAT WASHER
NUT
LOCKWASHER
FLAT WASHER
GASKET
SCREW
BRACKET
NUT
CABLE
THROTTLE CONTROL ARM
STOP
SETSCREW
AT 12729

Figure 2–206. Throttle control, removal and installation.

(1) *Removal.*

(*a*) Disconnect two electrical connectors (circuits 27 and 85) from rear of low air pressure warning indicator shutoff switch.

(*b*) Remove jamnut and lockwasher securing cutoff switch to instrument panel.

(*c*) Remove low air pressure warning indicator cutoff switch from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

l. Flame (Manifold) Heater Switch (Fig. 2–207).

(1) *Removal.*

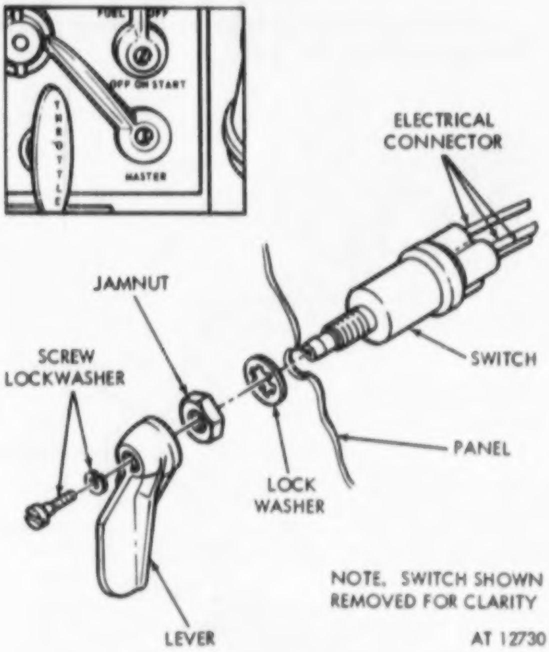

FUEL
OFF ON START
THROTTLE
MASTER
ELECTRICAL CONNECTOR
JAMNUT
SCREW
LOCKWASHER
SWITCH
PANEL
LOCK WASHER
NOTE. SWITCH SHOWN REMOVED FOR CLARITY
LEVER
AT 12730

Figure 2–207. Instrument panel switches, removal and installation (typical).

(*a*) Disconnect two electrical connectors (circuits 27 and 486) from rear of flame heater switch.

(*b*) Remove jamnut and lockwasher securing flame heater switch to instrument panel.

(*c*) Remove flame heater switch from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

m. Windshield Wiper Control Valve (Fig. 2–208).

(1) *Removal.*

(*a*) Release air from air system (para 2–169*b*) and disconnect three air lines from rear of windshield wiper control valve.

(*b*) Loosen setcrew inside of windshield wiper control valve knob and remove knob.

(*c*) Remove jamnut and washer securing windshield wiper control valve to instrument panel.

(*d*) Remove windshield wiper control valve from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

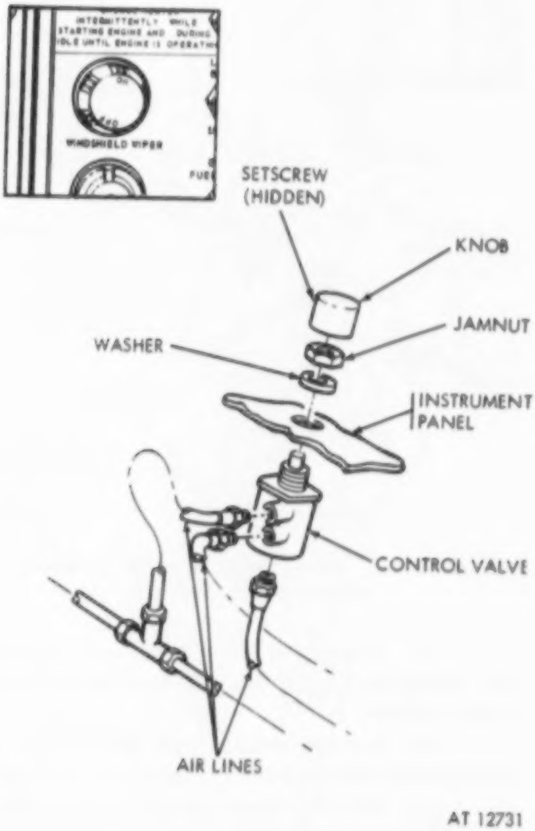

INTERMITTENTLY WHILE
STARTING ENGINE AND DURING
IDLE UNTIL ENGINE IS OPERATIN
WINDSHIELD WIPER
FUEL
SETSCREW (HIDDEN)
KNOB
JAMNUT
WASHER
INSTRUMENT PANEL
CONTROL VALVE
AIR LINES
AT 12731

Figure 2-208. Windshield wiper control valve, removal and installation.

2-96. Instrument Panel Indicators

a. Air Filter Indicator. Refer to paragraph 2-62 for removal and installation procedures for air filter indicator.

b. Transmission Temperature Indicator (Fig. 2-209).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuits 327 and 327A) from rear of transmission temperature indicator.

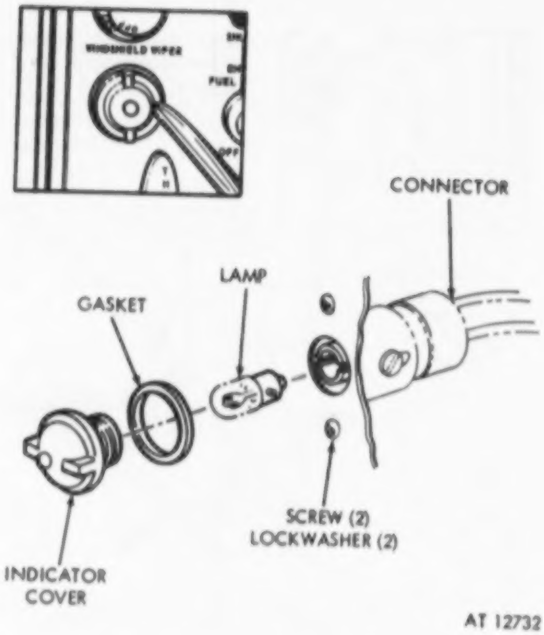

WINDSHIELD WIPER
FUEL
OFF
CONNECTOR
LAMP
GASKET
SCREW (2)
LOCKWASHER (2)
INDICATOR COVER
AT 12732

Figure 2-209. Transmission temperature indicator, removal and installation.

(*b*) Unscrew indicator cover (lens) and remove cover and gasket.

(*c*) Remove two screws and lockwashers securing indicator to instrument panel.

(*d*) Remove transmission temperature indicator from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

c. Bilge Pump Indicator (M656) (Fig. 2-210).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuits 451A and ground for cargo box or 452A and ground for cab) from rear of bilge pump indicator.

(*b*) Unscrew indicator cover (lens) and remove cover and gasket.

(*c*) Remove two screws and lockwashers securing indicator to instrument panel.

(*d*) Remove bilge pump indicator from rear of instrument panel.

(2) *Installation.* Refer to removal procedure and reverse sequence.

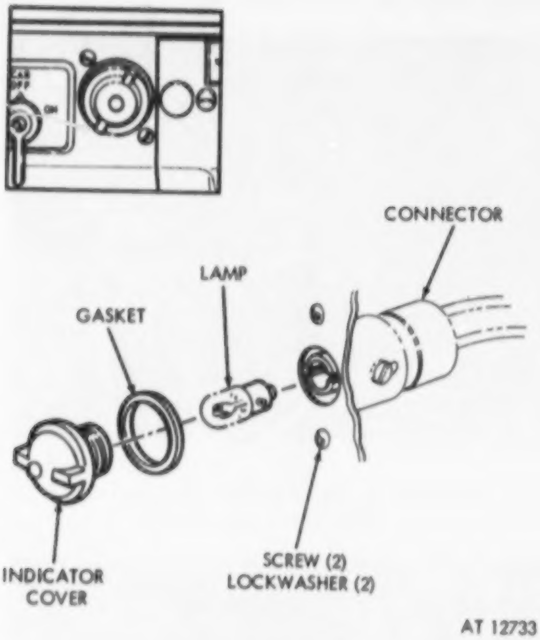

CONNECTOR
LAMP
GASKET
INDICATOR COVER
SCREW (2)
LOCKWASHER (2)
AT 12733

Figure 2-210. Bilge pump indicator, removal and installation.

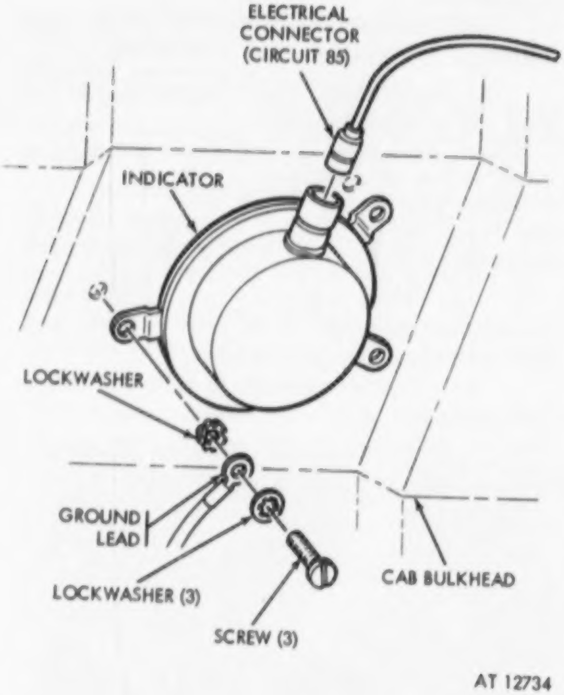

ELECTRICAL CONNECTOR (CIRCUIT 85)
INDICATOR
LOCKWASHER
GROUND LEAD
LOCKWASHER (3)
SCREW (3)
CAB BULKHEAD
AT 12734

Figure 2-211. Low air pressure warning indicator, removal and installation.

d. Low Air Pressure Warning Indicator (Buzzer) (Fig. 2-211).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 85) from warning indicator.

(*b*) Disconnect ground wire by removing one warning indicator retaining screw, and two lockwashers.

(*c*) Remove two remaining screws and lockwashers securing indicator to cab front bulkhead and remove low air pressure warning indicator.

(2) *Installation.* Refer to removal procedure and reverse sequence. Tighten retaining screws to 4-5 ft-lb.

Section XVIII. SAFETY SWITCHES, TRANSMITTERS AND CIRCUIT BREAKERS

2-97. General

This section contains replacement procedures for safety switches, transmitters, and circuit breakers. Except where specifically noted, items listed in this section are generally applicable to all vehicles covered in this manual.

2-98. Safety Switches

a. Neutral-Start Switch (Fig. 2-212).

(1) *Removal.*

(*a*) Remove engine hatch cover.

(*b*) Disconnect electrical connector (circuit 14A) from neutral-start switch.

(*c*) Remove jam nut and lockwasher

from inside of shift quadrant securing switch to quadrant.

(*d*) Remove neutral-start switch with adjusting nut and flat washer attached.

(2) *Installation.* Refer to removal procedure and reverse sequence.

Note. Adjustment of neutral-start switch is required at time of installation.

(3) *Adjustment.*

(*a*) Place transmission selector lever in "N" (neutral) position of shift quadrant.

(*b*) Turn adjusting nut until switch plunger is depressed from 0.25 to 0.30 inch. (Do not adjust for full travel.)

(*c*) Tighten jam nut to secure switch to shift quadrant. Make sure adjustment of switch was not disturbed during securing operation.

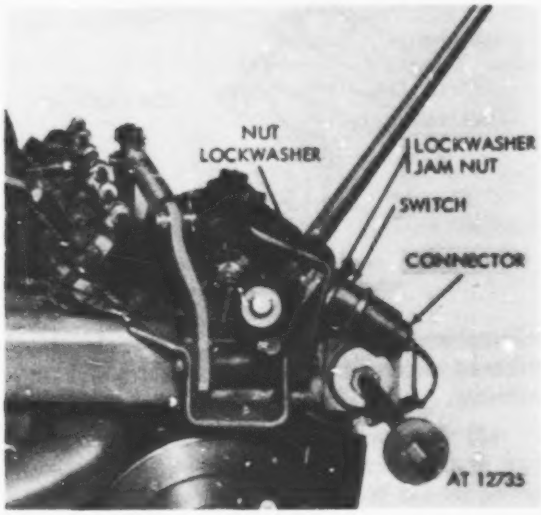


Figure 2-212. Neutral-start switch, removal, installation, and adjustment.

b. Low Air Pressure Warning Switch (Fig. *2-213*).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 85) at each end of warning switch.

(*b*) Release air from air system and disconnect air line from switch elbow.

(*c*) Remove two screws and lockwashers securing switch to cab forward bulkhead and remove low pressure warning switch.

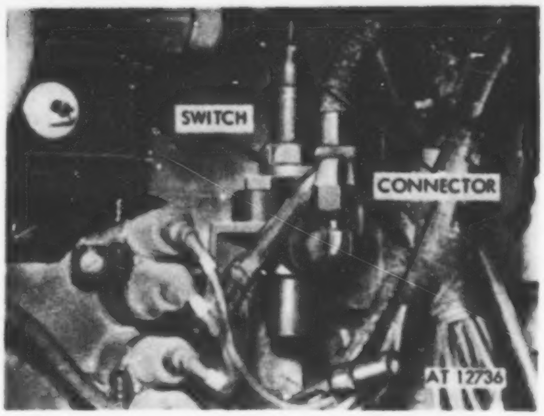


Figure 2-213. Low pressure warning switch, removal and installation.

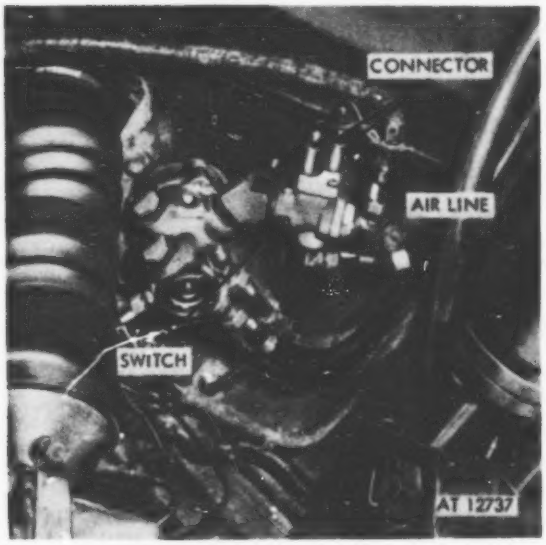


Figure 2-214. Stoplight switch, removal and installation.

(2) Installation. Refer to removal procedure and reverse sequence.

c. Stoplight Switch (*Fig. 2-214*).

(1) *Removal.*

(*a*) Disconnect two electrical connectors (circuit 75) from stop-light switch.

(*b*) Release air from air system and

disconnect two air lines from stoplight switch (XM757 only).

(*c*) Unscrew and remove stoplight switch from fitting on treadle valve.

(2) *Installation.* Refer to removal procedure and reverse sequence.

2-99. Transmitters

a. Oil Pressure Transmitter (Fig. 2-215).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 36) from top of transmitter.

(*b*) Unscrew and remove transmitter from adapter mounted on side of engine block.

(2) *Installation.* Refer to removal procedure and reverse sequence.

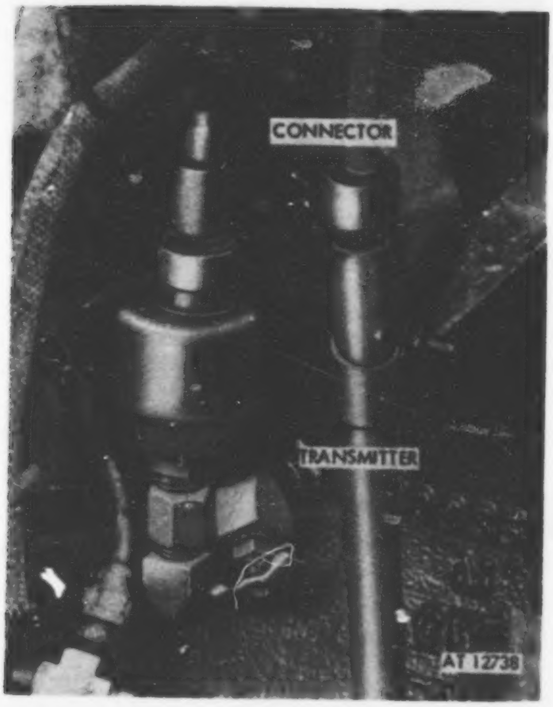


Figure 2-215. Oil pressure transmitter, removal and installation.

b. Fuel Level Transmitter (Fig 2-216).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 28) from transmitter.

(*b*) Disconnect ground wire (circuit 79) from transmitter by removing one of the screws securing transmitter to fuel tank.

(*c*) Remove four remaining screws securing transmitter to fuel tank and remove transmitter.

Caution: **Use care in removing transmitter to avoid damage to float or gasket. Cover tank to prevent entry of dirt, and observe all safety precautions.**

(2) *Installation.* Refer to removal procedure and reverse sequence. Use caution to avoid damage to float or gasket.

GROUND WIRE
TRANSMITTER
CONNECTOR
AT 12739

Figure 2-216. Fuel level transmitter, removal and installation.

c. Engine Coolant Temperature Transmitter (Fig. 2-217).

(1) *Removal.*

(*a*) Remove radiator cap and open engine block drain cock and drain coolant into suitable container.

(*b*) Disconnect electrical connector (circuit 33) from transmitter.

(*c*) Unscrew and remove engine coolant

temperature transmitter from side of water manifold.

(2) *Installation.* Refer to removal procedure and reverse sequence. Refer to LO 9-2320-230-12 and fill engine coolant system.

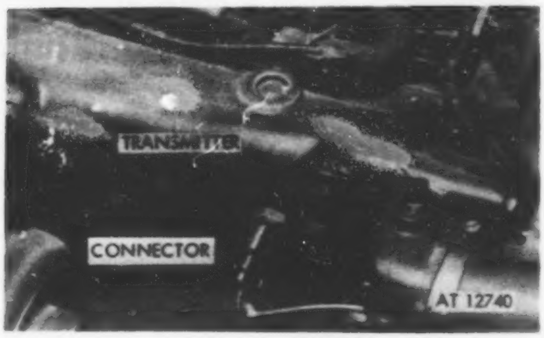

TRANSMITTER
CONNECTOR
AT 12740

Figure 2-217. Engine coolant temperature transmitter, removal and installation.

d. Transmission Oil Temperature Transmitter (Fig. 2-218).

(1) *Removal.*

(*a*) Disconnect electrical connector (circuit 327A) from transmitter.

(*b*) Unscrew and remove transmission oil temperature transmitter from fitting attached to transmission oil outlet port.

(2) *Installation.* Refer to removal procedure and reverse sequence.

2-100. Circuit Breakers

a. Removal (Fig. 2-219).

(1) Disconnect two electrical connectors from circuit breaker to be removed.

(2) Remove two screws and lockwashers securing circuit breaker to cab forward bulkhead and remove circuit breaker.

b. Installation. Refer to removal procedure and reverse sequence.

Caution: **Make sure the circuit breaker being installed has same amperage rating as the one that was removed.**

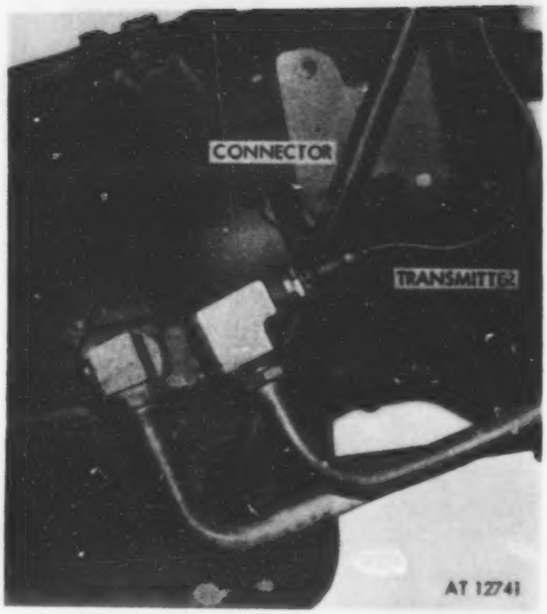

CONNECTOR
TRANSMITTER
AT 12741

Figure 2-218. Transmission oil temperature transmitter, removal and installation.

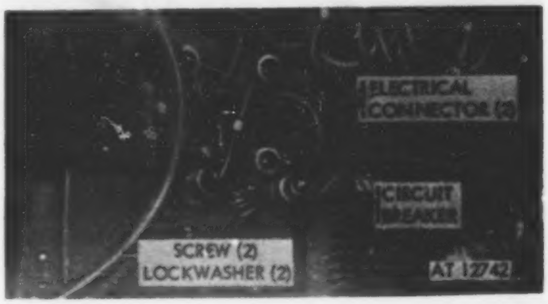

ELECTRICAL
CONNECTOR (2)
CIRCUIT
BREAKER
SCREW (2)
LOCKWASHER (2)
AT 12742

Figure 2-219. Circuit breaker, removal and installation.

Section XIX. DIRECTIONAL TURN SIGNALS AND HORN

2-101. General

This section contains replacement procedures for directional turn signals and components. Also included are replacement procedures for horn and components. Except where specifically noted, items listed in this section are generally applicable to all vehicles covered in this manual.

2-102. Directional Signal Control (Fig. 2-220)

a. Removal.

(1) Disconnect electrical cable connector underneath directional control.

(2) Unscrew and disconnect clamp securing signal control to steering column and remove directional signal control.

b. Installation. Refer to removal procedure and reverse sequence.

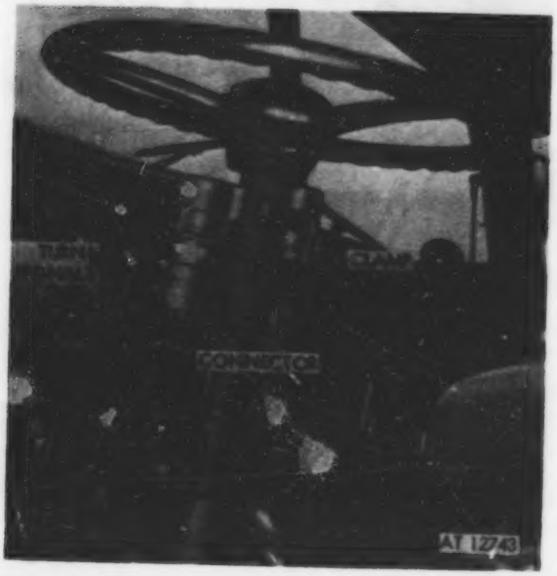


Figure 2-220. Directional signal control, removal and installation.

2-103. Directional Signal Flasher Unit (Fig. 2-221)

a. Removal.

(1) Disconnect electrical cable connector from side of flasher unit.

(2) Remove two screws and lockwashers securing flasher unit to cab forward bulkhead and remove directional signal flasher unit.

b. Installation. Refer to removal procedure and reverse sequence.

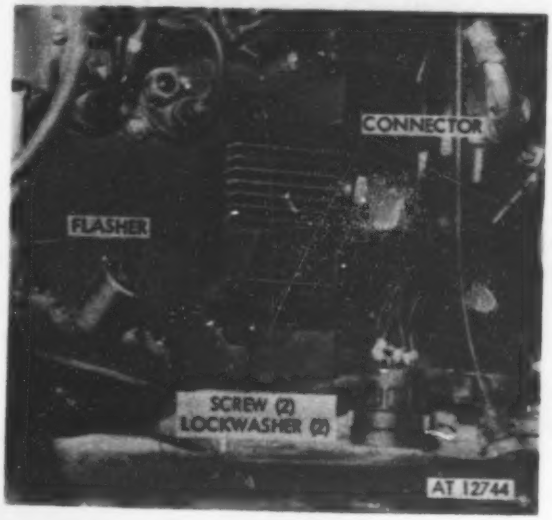


Figure 2-221. Directional signal flasher unit, removal and installation.

2-104. Directional Signal Control Indicator Lamp (Fig. 2-222)

a. Removal.

(1) Unscrew and remove lamp cover (lens).

(2) Remove indicator lamp by pushing in and turning counterclockwise.

b. Installation. Refer to removal procedure and reverse sequence.

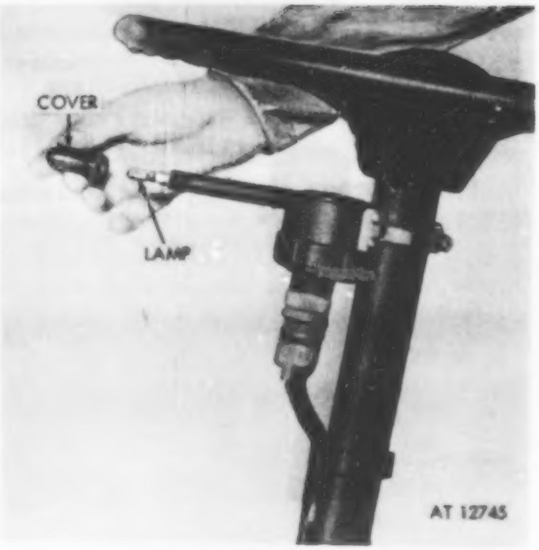

COVER
LAMP
AT 12745

Figure 2-222. Directional signal control indicator lamp, removal and installation.

2-105. Horn Button (Fig. 2-223)

a. Removal.

(1) Pry up and remove horn button cover from steering wheel.

(2) Depress horn button and turn slightly and remove horn button from steering wheel.

(3) Remove contact cup, horn button spring, and contact cap.

(4) Remove three screws and remove base plate assembly and grounding spring.

b. Installation. Refer to removal procedure and reverse sequence.

2-106. Horn Cover and Contact Assembly (Fig. 2-223)

a. Removal.

(1) Disconnect electrical lead (circuit 25) from contact terminal.

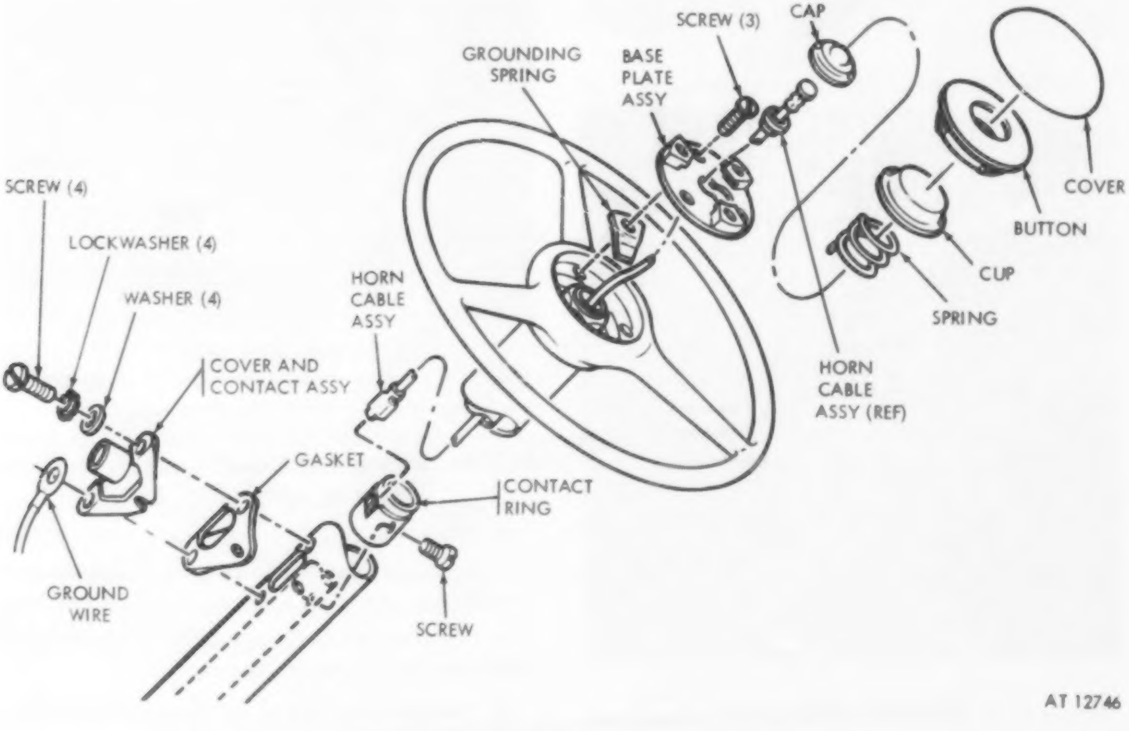

SCREW (3)
CAP
GROUNDING SPRING
BASE PLATE ASSY
COVER
BUTTON
CUP
SPRING
HORN CABLE ASSY (REF)
SCREW (4)
LOCKWASHER (4)
WASHER (4)
HORN CABLE ASSY
COVER AND CONTACT ASSY
GASKET
CONTACT RING
GROUND WIRE
SCREW
AT 12746

Figure 2-223. Horn button, cover and contact, and cable, removal and installation.

(2) Remove four screws, lockwashers, and flat washers and lift horn cover and contact assembly away from steering column.

b. Installation. Refer to removal procedure and reverse sequence.

2-107. Horn Cable (Fig. 2-223)

a. Removal.

(1) Remove horn button (para 2-105).

(2) Remove horn cover and contact assembly (para 2-106).

(3) Disconnect horn cable from contact ring by sliding terminal off contact ring at opening in steering column that was covered by horn cover and contact assembly.

(4) Attach lead line (small wire or string) to horn cable terminal to be used during installation procedure. Lead line must be 36 inches or longer.

(5) Pull horn cable at horn button end from steering column while making sure loose end of lead line does not enter steering column.

(6) Disconnect horn cable from lead line and leave lead line in steering column.

b. Installation.

(1) Attach steering wheel end of lead line that was left in steering column during removal procedure to terminal end of horn cable.

(2) Pull lead line at cover and contact assembly end and pull horn cable through steering column.

(3) Remove lead line and connect terminal of horn cable to contact ring at cover and contact assembly opening.

(4) Install horn cover and contact assembly (para 2-106).

(5) Install horn button (para 2-105).

2-108. Horn (Fig. 2-224)

a. Removal.

(1) Disconnect two electrical connectors (circuit 25) from horn.

(2) Remove two nuts, lockwashers, bolts, and plate securing horn to mounting bracket and remove horn.

b. Installation. Refer to removal procedure and reverse sequence.

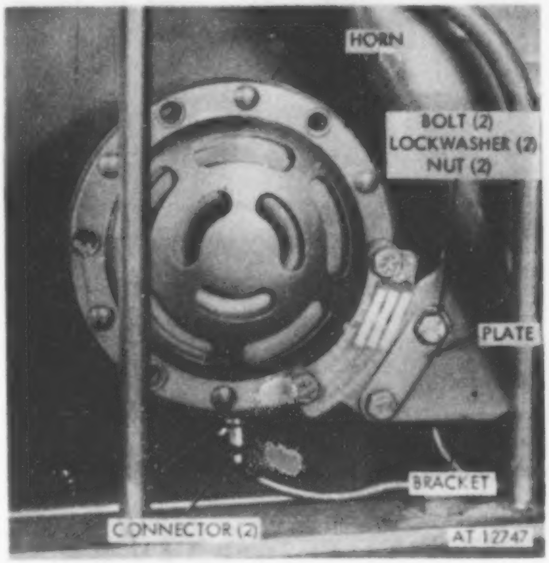


Figure 2-224. Horn, removal and installation.

Section XX. HEADLIGHTS, TAILLIGHTS, AND BATTERY

2-109. General

This section contains replacement or repair procedures for headlights, taillights, and battery. Except where noted, items listed in this section are generally applicable to all vehicles covered in this manual.

2-110. Service Headlights Replacement (Fig. 2-225)

a. Removal.

(1) Disconnect three electrical connectors (circuits 17, 18, and 91) from rear of headlight unit.

(2) Remove three stop nuts securing headlight unit to cab and remove headlight unit.

b. Installation. Refer to removal procedure and reverse sequence. Adjust headlight as prescribed in paragraph 2-112.

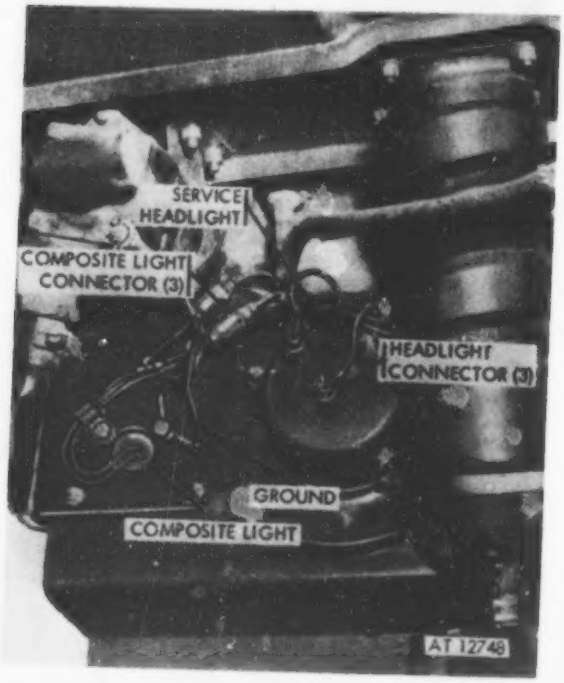


Figure 2-225. Service and front composite headlights replacement.

2-111. Headlights Repair (Fig. 2-226)

a. General. Repair of the headlights consists of replacement of defective parts or sealed-beam lamp.

b. Replacing Sealed-Beam Lamp.

(1) Remove three screws securing retaining rim on front of headlight and remove retaining rim.

(2) Remove three screws securing retaining ring to headlight housing and remove retraining ring.

(3) Remove sealed-beam lamp and disconnect three electrical connectors.

c. Installation. Refer to removal procedure and reverse sequence. Adjust headlight as prescribed in paragraph 2-112.

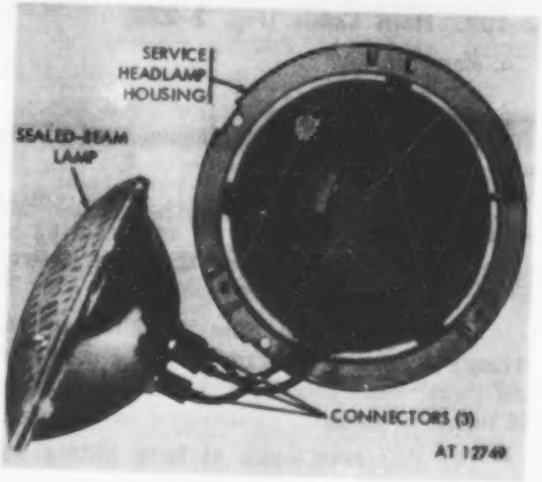


Figure 2-226. Headlight repair.

2-112. Headlights Adjustment

a. To reduce service headlight glare and prevent temporary blinding of the operator of the oncoming vehicle, headlights must be adjusted properly. The headlight beam direction is changed by two lamp-unit adjusting screws, located behind holes in rim; one at the top and one on the side. Turn the top adjusting screw to change the direction of the beam vertically, and turn the side adjusting screw to change the direction horizontally. Adjust the lights as detailed in *b* through *h* below.

b. Place the unloaded vehicle on a smooth level surface so that the headlights are 25 feet away from a vertical wall or other vertical surface. The centerline of vehicle must be at right angles to the vertical surface. Use the service headlight adjustment diagram (fig. 2-227) for aid in laying out the adjustment lines.

c. Measure the height of the headlight center from the floor, and mark a horizontal line (X-X) at this height on the vertical surface.

d. Mark a line (A–A) one-twelfth of the distance between line (X–X) and the floor below line (X–X).

e. Draw vertical lines (B–B) and (C–C) directly in front of each headlight.

f. Turn on the headlights at the light switch and select the high beam with the headlight beam selector switch.

g. Cover one headlight while adjusting the other. Aim the headlight so that the center of the hot (brightest) spot registers with the intersecting lines (A–A) and (B–B), or (A–A) and (C–C) respectively.

h. After each light is aimed separately, check both lights simultaneously for conformity to line (A–A).

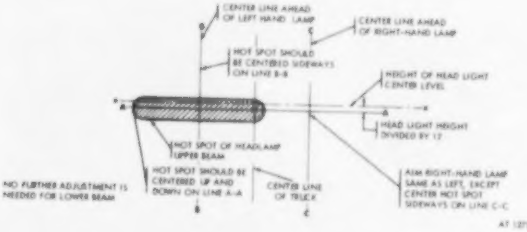

CENTER LINE AHEAD OF LEFT HAND LAMP
CENTER LINE AHEAD OF RIGHT-HAND LAMP
HOT SPOT SHOULD BE CENTERED SIDEWAYS ON LINE B-B
HEIGHT OF HEAD LIGHT CENTER LEVEL
HEAD LIGHT HEIGHT DIVIDED BY 12
HOT SPOT OF HEADLAMP UPPER BEAM
NO FURTHER ADJUSTMENT IS NEEDED FOR LOWER BEAM
HOT SPOT SHOULD BE CENTERED UP AND DOWN ON LINE A-A
CENTER LINE OF TRUCK
AIM RIGHT-HAND LAMP SAME AS LEFT, EXCEPT CENTER HOT SPOT SIDEWAYS ON LINE C-C
B
C
A
AT 12750

Figure 2-227. Headlights adjustment.

2-113. Headlight Beam Selector Switch (Fig. 2-228)

a. Removal.

(1) Remove three screws and lockwashers securing headlight beam selector switch to mounting bracket and remove switch.

(2) Disconnect three electrical connectors (circuits 16, 17 and 18) from rear of switch.

b. Installation. Refer to removal procedure and reverse sequence.

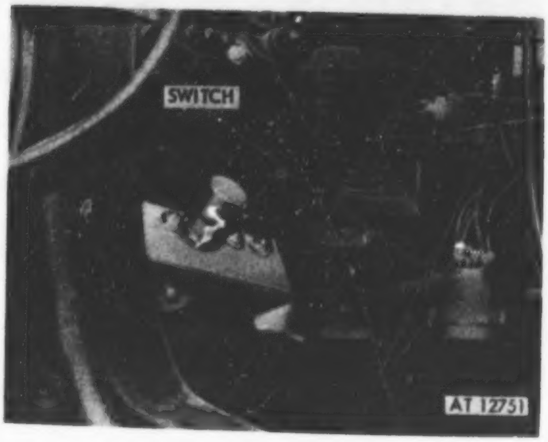

SWITCH
AT 12751

Figure 2-228. Headlight beam selector switch, removal and installation.

2-114. Front Composite Light Replacement (Fig. 2-225)

a. Removal.

(1) Disconnect three electrical connectors (circuits 20, 491, and 460–461) from rear of light.

(2) Remove screw and lockwasher and disconnect ground lead.

(3) Remove screw, lockwasher, and cable clamp.

(4) Remove front composite light from front of vehicle.

b. Installation. Refer to removal procedure and reverse sequence. Refer to paragraph 2-116 for adjustment.

2-115. Front Composite Light Repair (Fig. 2-229)

a. General. Repair of the front composite light consists of replacement of defective parts or lamps.

b. Replacing Lamps.

(1) Disconnect six captive screws securing cover to light housing and remove cover.

(2) Press in and turn lamp to be replaced and remove lamp.

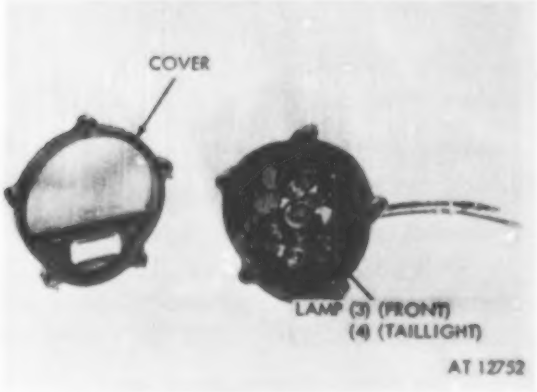

COVER
LAMP (3) (FRONT)
(4) (TAILLIGHT)
AT 12752

Figure 2-229. Front composite light or service taillight lamp replacement.

c. Installation. Refer to removal procedure and reverse sequence.

2-116. Blackout Drive Light Replacement (Fig. 2-230)

a. Removal.

(1) Disconnect electrical connector (circuit 19) from rear of light.

(2) Remove nut and lockwasher securing light to mounting bracket, disconnect ground wire and remove light.

b. Installation. Refer to removal procedure and reverse sequence.

2-117. Blackout Drive Light Repair (Fig. 2-231)

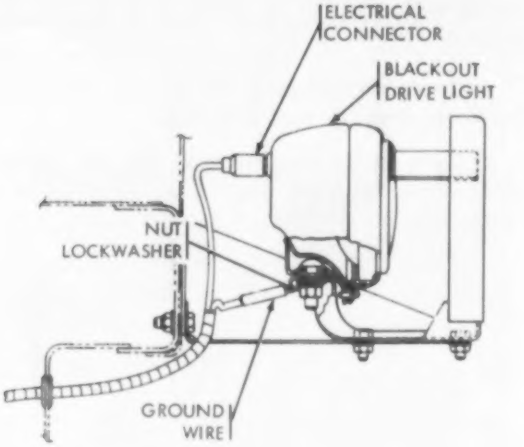
a. General. Repair of blackout drive light consists of replacement of defective parts or sealed-beam unit.

b. Replacing Sealed-Beam Unit.

(1) Loosen three captive screws securing light cover to light housing and pull away cover.

(2) Disconnect electrical connector from rear of sealed beam unit.

(3) Remove spring type ring securing sealed beam too cover and remove sealed beam unit.


ELECTRICAL CONNECTOR
BLACKOUT DRIVE LIGHT
NUT
LOCKWASHER
GROUND WIRE

AT 12753

Figure 2-230. Blackout drive light removal and installation.

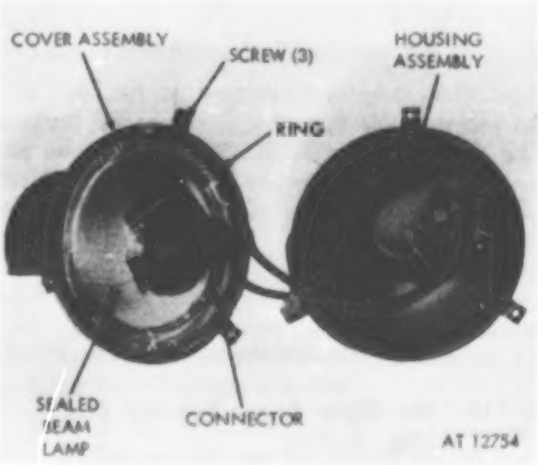

COVER ASSEMBLY
SCREW (3)
HOUSING ASSEMBLY
RING
SEALED BEAM LAMP
CONNECTOR
AT 12754

Figure 2-231. Blackout drive light repair.

c. Installation. Refer to removal procedure and reverse sequence.

2-118. Blackout Drive Light Adjustment

The blackout headlamp may be aimed by loosening lock nut slightly. Aim the lamp so that the beam distribution on a level road shall be such as to give a beam 30 feet wide of uniformly decreasing intensity, from a point 100 in front of the vehicle, with the top of the light beam directed not less than 1° below the horizontal. Tighten lock nut to maintain adjustment.

2–119. Composite Taillight Replacement (Fig. 2–232)

a. Removal.

(1) Disconnect four electrical connectors (circuits 21, 23, 24, and 22–460 or 22–461) from rear of light.

(2) Remove one retaining screw and lockwasher and remove cable clamp.

(3) Remove remaining retaining screw securing light to mounting bracket and remove service taillight.

b. Installation. Refer to removal procedure and reverse sequence.

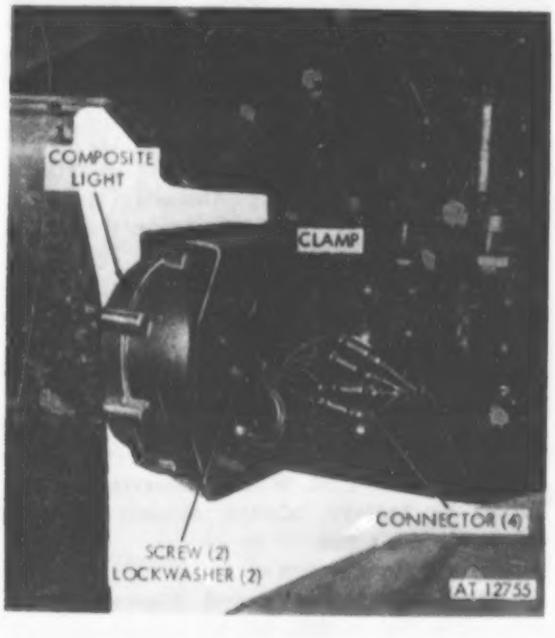


Figure 2–232. Service taillight removal and installation.

2–120. Composite Taillight Repair (Fig. 2–229)

a. Repair of the composite taillight consists of replacement of defective parts or lamps.

b. Replacing Composite Taillight Lamps.

(1) Loosen six captive screws securing light cover to light housing and remove cover.

(2) Press in and turn lamp to be replaced and remove lamp.

c. Installation. Refer to removal procedure and reverse sequence.

2–121. Batteries and Battery Holddown Frame

a. Battery Service. Battery service consists of periodic tests of electrolyte specific gravity, adding water to electrolyte, recharging, and cleaning.

Note. Tilt passenger seat forward to gain access to battery box.

(1) Use hydrometer to check specific gravity of each cell of the two 12-volt, type US–6TN storage batteries. If extreme temperatures are encountered, use a thermometer to measure temperature of electrolyte to enable correction of hydrometer reading obtained (fig. 2–15). Corrected specific gravity reading of 1.275 to 1.290 in all cells indicates a fully charged battery. A specific gravity reading of 1.225 or less in any cell indicates the battery must be charged or replaced. The maximum allowable variation in specific gravity readings between cells is 0.025 for a charged battery.

(2) Inspect each cell of battery to determine electrolyte level. Add distilled water, when required, to maintain electrolyte level to $\frac{3}{4}$ inch above cell plates and separators.

(3) Charge batteries, if required, as prescribed in TM 9–6140–200–15. Use waste cloth to wipe up any spilled electrolyte.

(4) Before cleaning batteries, remove them from vehicle battery box as prescribed in *b* below. Clean the tops of batteries using a stiff non-metallic brush and an alkaline solution such as ammonia or a solution of bicarbonate of soda and water. When foaming stops,

flush top of batteries with clean water to remove residue. If lug terminals are corroded, clean terminals with alkaline solution in same manner.

Caution: **If batteries are removed from vehicle battery box, flush off any spilled electrolyte with clear water and wipe dry with waste cloth.**

b. Removal. (*Fig. 2-233*)

(1) Tilt passenger seat forward to gain access to battery box.

(2) Unlatch and open battery box cover.

Caution: **When disconnecting battery cables from battery, always disconnect negative (ground) cable first. When connecting battery cables to battery, always connect negative (ground) cable last.**

(3) Loosen nut securing lug terminal and negative (ground) cable to battery post and pull terminal and negative (ground) cable away from battery post. Tape lug terminal with pressure sensitive tape to avoid accidental contact with batteries.

(4) Loosen nut securing lug terminal and positive cable to battery post and pull terminal and positive cable away from battery post. Tape lug terminal with pressure sensitive tape to avoid accidental contact with batteries.

(5) Loosen two nuts securing lug terminals and interconnecting cable to battery posts and remove interconnecting cable and lug terminals.

(6) Remove four nuts, lockwashers, and flat washers and remove battery holddown frame.

Caution: **Do not use lifting strap connected to battery posts for removing battery. Lift batteries by lifting handles at side of batteries only.**

(7) Remove batteries from battery box by lifting handles on side of batteries.

c. Battery Holddown Frame Repair. Wash battery hold down frame with alkaline solution such as ammonia or a solution of bicarbonate of soda and water. Use wire brush or abrasive paper to clean bare metal surfaces. Frame that is bent or otherwise deformed must be straightened. Paint any exposed bare metal surfaces as prescribed in TM 9-213.

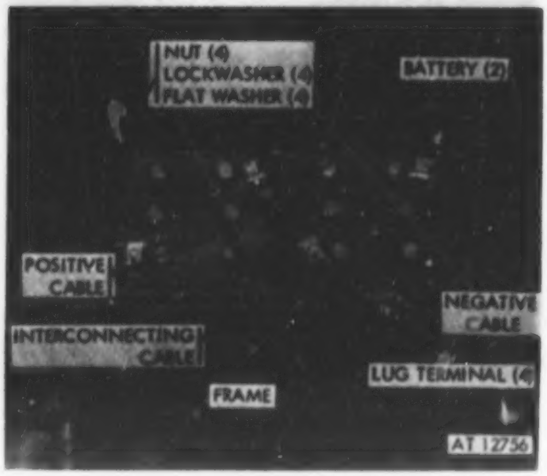


Figure 2-233. Battery and battery holddown frame, removal and installation.

d. Installation. Refer to removal procedure and reverse sequence.

Note. Before installing hold down nuts of battery hold down frame, clean threads of nuts and bolts and place several drops of oil on threads. After cables are secured to battery posts, coat lug terminals with grease, GAA, to prevent corrosion.

2-122. Battery Cables

a. Battery Negative (Ground) Cable.

(1) *Removal.*

(*a*) Tilt passenger seat forward to gain access to battery box.

(*b*) Unlatch and open battery box cover.

Caution: **When disconnecting battery cables from battery, always disconnect negative (ground) cable first. When connecting battery cables to battery, always connect negative (ground) cable last.**

(*c*) Remove nut securing negative cable to negative lug terminal and disconnect negative cable (fig. 2-233).

(*d*) Disconnect electrical connector from instrument panel ground cable.

(*e*) Remove engine hatch cover and disconnect negative cable at receptacle (fig. 2-234).

(*f*) Remove four nuts and bolts securing negative cable receptacle to engine bulkhead, and pull receptacle away from bulkhead.

(*g*) Pull portion of cable that connects to battery lug terminal, through grommet in battery box and remove battery negative cable.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Battery Positive Cable.

(1) *Removal.*

(*a*) Tilt passenger seat forward to gain access to battery box.

(*b*) Unlatch and open battery box cover.

Caution: **When disconnecting battery cables from battery, always disconnect negative (ground) cable first. When connecting battery cables to battery, always connect negative cable last.**

(*c*) Loosen nut securing lug terminal and negative cable to battery and pull away lug terminal and negative cable. Tape terminal to prevent accidental contact with batteries.

(*d*) Remove engine hatch cover and disconnect positive cable at receptacle (fig. 2-234).

(*e*) Remove nut securing positive cable to positive lug terminal and disconnect battery positive cable (fig. 2-233).

(*f*) Disconnect electrical connector from instrument panel positive cable.

(*g*) Remove four nuts and bolts securing positive cable receptacle to engine bulkhead, and pull receptacle away from bulkhead.

(*h*) Pull portion of cable that connects to battery lug terminal, through grommet in battery box and remove battery positive cable.

(2) *Installation.* Refer to removal procedure and reverse sequence.

c. Battery Interconnecting Cable.

(1) *Removal.*

(*a*) Disconnect battery negative (ground) and positive cables as prescribed in *a* and *b* above.

(*b*) Remove nuts at each end of interconnecting cable (fig. 2-233) that secures cable to lug terminals and remove cable.

(2) *Installation.* Refer to removal procedure and reverse sequence.

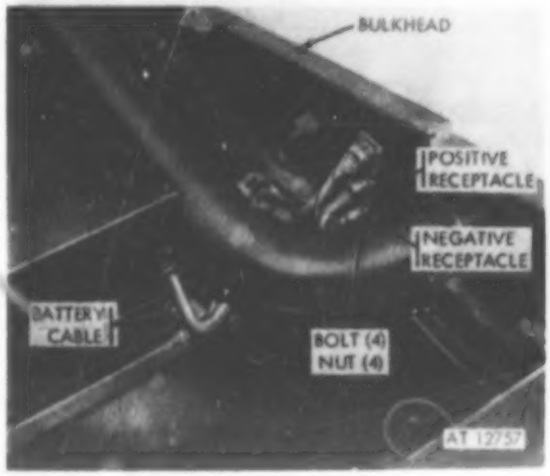


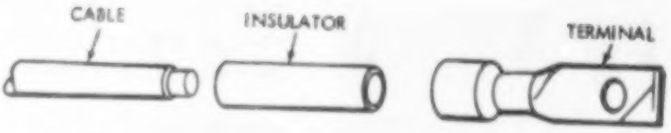
Figure 2-234. Battery cables, removal and installation.

Section XXI. CHASSIS WIRING HARNESS, CABLES, AND RECEPTACLES

2-123. General

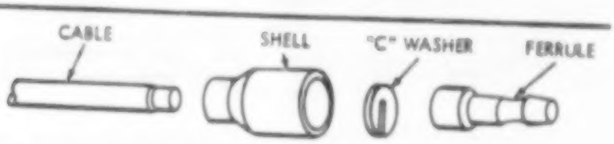
a. This section contains replacement or repair procedures for the chassis wiring harness, cables, and receptacles. Except where specifically noted, ietms listed in this section are generally applicable to all vehicles covered in this manual.

b. The repair of cables or harnesses is limited to the replacement of connectors or terminals. Wires with crimped or soldered terminals


CABLE
INSULATOR
TERMINAL

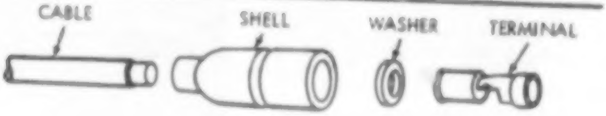
1 - STRIP CABLE INSULATION EQUAL TO DEPTH OF TERMINAL WELL.
2 - SLIDE INSULATOR OVER CABLE.
3 - INSERT CABLE INTO TERMINAL WELL AND CRIMP.
4 - SLIDE INSULATOR OVER CRIMPED END OF TERMINAL.

A - TERMINAL-TYPE CABLE CONNECTORS


CABLE
SHELL
"C" WASHER
FERRULE

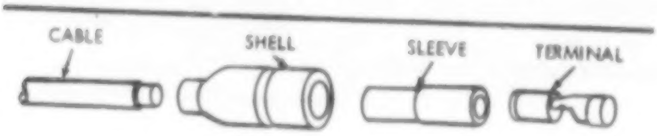
1 - STRIP CABLE INSULATION EQUAL TO DEPTH OF FERRULE WELL.
2 - SLIDE SHELL OVER CABLE.
3 - INSERT CABLE INTO FERRULE WELL AND CRIMP.
4 - PLACE "C" WASHER OVER CABLE AT CRIMPED JUNCTION AND
SLIDE SHEEL OVER "C" WASHER AND TERMINAL.

B - MALE CABLE CONNECTOR


CABLE
SHELL
WASHER
TERMINAL

1 - STRIP CABLE INSULATION APPROXIMATELY 1/8 INCH.
2 - SLIDE SHELL AND WASHER OVER CABLE.
3 - PLACE CABLE IN CYLINDRICAL END OF TERMINAL AND CRIMP.
4 - SLIDE SHELL AND WASHER OVER TERMINAL.

C - FEMALE CABLE CONNECTOR (WITH WASHER)

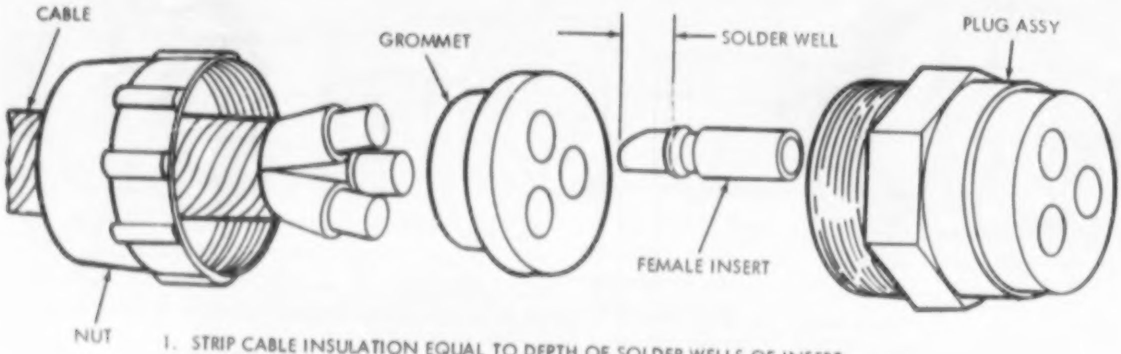

CABLE
SHELL
SLEEVE
TERMINAL

1 - STRIP CABLE INSULATION APPROXIMATELY 1/8 INCH.
2 - SLIDE SHELL AND SLEEVE OVER CABLE.
3 - PLACE CABLE IN CYLINDRICAL END OF TERMINAL AND CRIMP.
4 - SLIDE SHELL AND SLEEVE OVER TERMINAL.

D - FEMALE CABLE CONNECTOR (WITH SLEEVE)

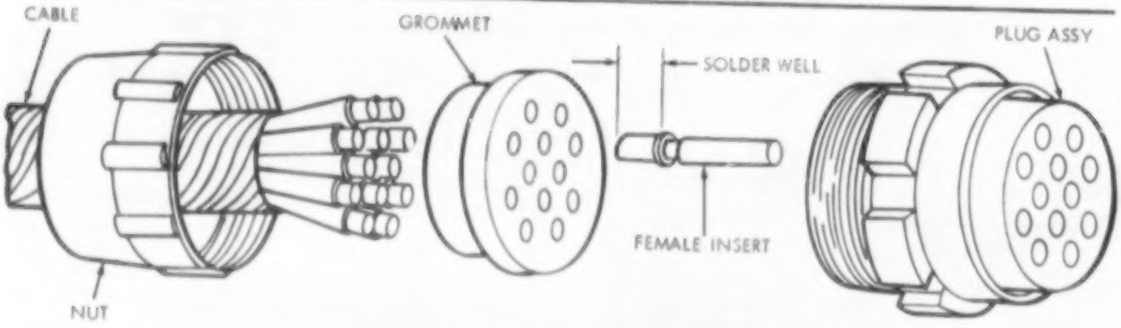
AT 12758

Figure 2-226. Replacing cable connectors.



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERT.
2. REMOVE NUT FROM PLUG ASSEMBLY AND SLIDE OVER CABLE.
3. REMOVE GROMMET FROM PLUG ASSEMBLY.
4. PASS CABLE ENDS THROUGH GROMMET, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER.
5. SLIDE GROMMET OVER INSERTS AND PRESS INTO PLUG ASSEMBLY.
6. THREAD NUT TO PLUG ASSEMBLY.

A - FEMALE-TYPE PLUG ASSEMBLY (WITH HEXAGON COUPLING PLUG)



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERTS.
2. REMOVE NUT FROM PLUG ASSEMBLY AND SLIDE OVER CABLE.
3. REMOVE GROMMET FROM PLUG ASSEMBLY.
4. PASS CABLE ENDS THROUGH GROMMET, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER.
5. SLIDE GROMMET OVER INSERTS AND PRESS INTO PLUG ASSEMBLY UNTIL SEATED.
6. THREAD NUT TO PLUG ASSEMBLY.

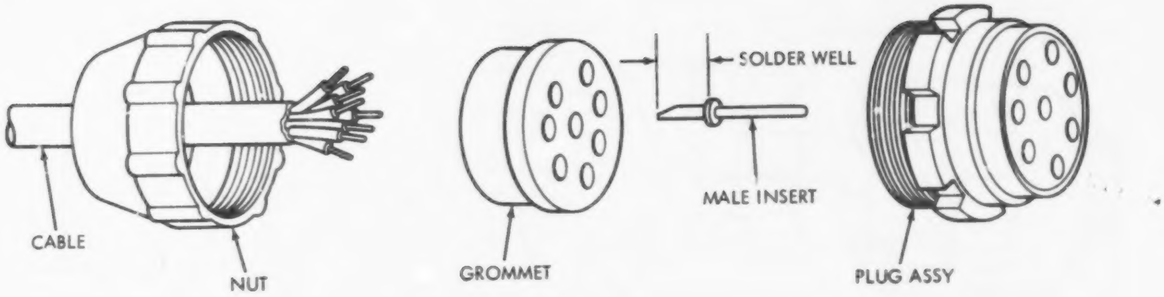
B - FEMALE-TYPE PLUG ASSEMBLY (WITH SPLINED PLUG)

AT 12759

Figure 2–236. Replacing cable of female plugs.

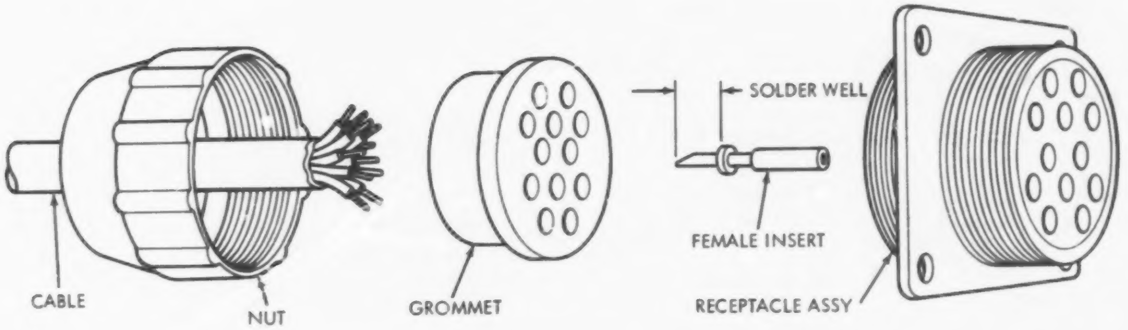
may be repaired. When soldering to make electrical connections, use rosin-core solder only. All repairs to electrical cables will be made in accordance with TB ORD 650.

c. Refer to electrical system wiring diagrams given in Section VII to determine electrical lead circuit number corresponding to identification band on electrical lead. Use a voltmeter, set to a suitable range to measure 24 volts, dc, between vehicle chassis (negative) and the electrical lead (positive) under test. Disconnect vehicle battery and use ohmmeter to make



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERTS.
2. REMOVE NUT FROM PLUG ASSEMBLY AND SLIDE OVER CABLE.
3. REMOVE GROMMET FROM PLUG ASSEMBLY.
4. PASS CABLE ENDS THROUGH GROMMET, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER.
5. SLIDE GROMMET OVER INSERTS AND PRESS INTO PLUG ASSEMBLY UNTIL SEATED.
6. THREAD NUT TO PLUG ASSEMBLY.

A - MALE-TYPE PLUG ASSEMBLY



1. STRIP CABLE INSULATION EQUAL TO DEPTH OF SOLDER WELLS OF INSERTS.
2. REMOVE NUT FROM PLUG ASSEMBLY AND SLIDE OVER CABLE.
3. REMOVE GROMMET FROM RECEPTACLE ASSEMBLY.
4. PASS CABLE ENDS THROUGH GROMMET, INSERT INTO SOLDER WELLS OF INSERTS AND SOLDER.
5. SLIDE GROMMET OVER INSERTS AND PRESS INTO RECEPTACLE ASSEMBLY.
6. THREAD NUT TO RECEPTACLE ASSEMBLY.

B - FEMALE-TYPE RECEPTACLE ASSEMBLY

AT 12760

Figure 2-237. Replacing cable male plugs and female receptacles.

point-to-point tests on individual circuits to establish continuity of electrical leads.

d. Plugs and connectors are standard items. Refer to figures 2-235 through 237 for general guide lines for repair. Refer to TM 9-1825E for specific repair procedures.

2-124. Description

The chassis wiring harness is made up of cables, connectors, plugs, receptacles, and terminals required to carry power to the vehicle electrical components. Harness is secured to the vehicle by clips or straps and terminate in the connector plugs, connector receptacles, or the cable terminals. All connectors are protected by rubber sealing gaskets or grommets to ensure waterproof connections. A trailer electric coupling receptacle is provided on all trucks for connecting electric power to pintle towed trailers.

2-125. Chassis Wiring Harness

a. Repair. Refer to figures 2-235 through 2-227 for general harness repair and to TB ORD 650 for specific repair. In addition, the methods listed below may be used for simple repairs.

(*1*) Remove all loose outer covering and clean conduit and remaining covering with rubber solvent and wipe dry.

(*2*) Wrap cable with insulating tape from end to end, making sure to have a lap joint one-half the width of the tape. Tie the loose end of tape at the connector.

(*3*) Resolder any wires that have broken or pulled off connector terminal.

(*4*) Clean corrosion from pin terminal and pin socket connector fittings with sandpaper or crocus cloth.

(*5*) Connect loose connectors and inspect rubber grommets. Replace grommet if required.

b. Circuit Identification. The different circuits can be identified from wiring diagrams (fig. 2-80 through 2-82). All harness terminals and separate cables or leads on the vehicle have metal tags that identify the circuit numbers.

Section XXII. TRANSMISSION AND TRANSMISSION OIL COOLER

2-126. General

This section contains replacement procedures for the transmission oil filter element, oil cooler, thermostat and oil lines. It also provides removal, installation and adjustment of the transmission shift control rods.

a. Transmission. Refer to paragraph 2-35 for a description of the transmission, and to paragraph 2-38 for separation of the transmission from the engine.

b. Transmission Oil Cooler. Refer to paragraph 2-76 for removal of the oil cooler from the power plant.

2-127. Transmission Oil Filter

a. Removal.

Note. Transmission fluid should be drained after vehicle operation and while oil is warm.

(1) Remove the transmission drain plug and gasket (fig. 2-238).

(2) Inspect drain plug gasket for damage and deterioration. Replace if necessary.

(3) After fluid has drained, replace gasket and plug. Tighten plug.

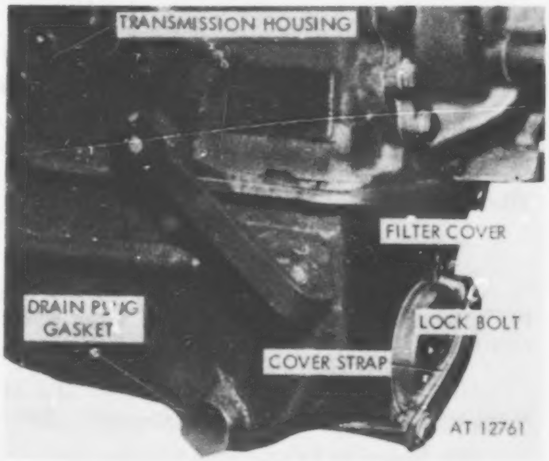


Figure 2-238. Transmission drain plug, oil filter strap and cover.

(4) Loosen (do not remove) filter cover strap bolt and disconnect cover strap.

(5) Remove filter cover, retainer, and filter element (fig. 2-239).

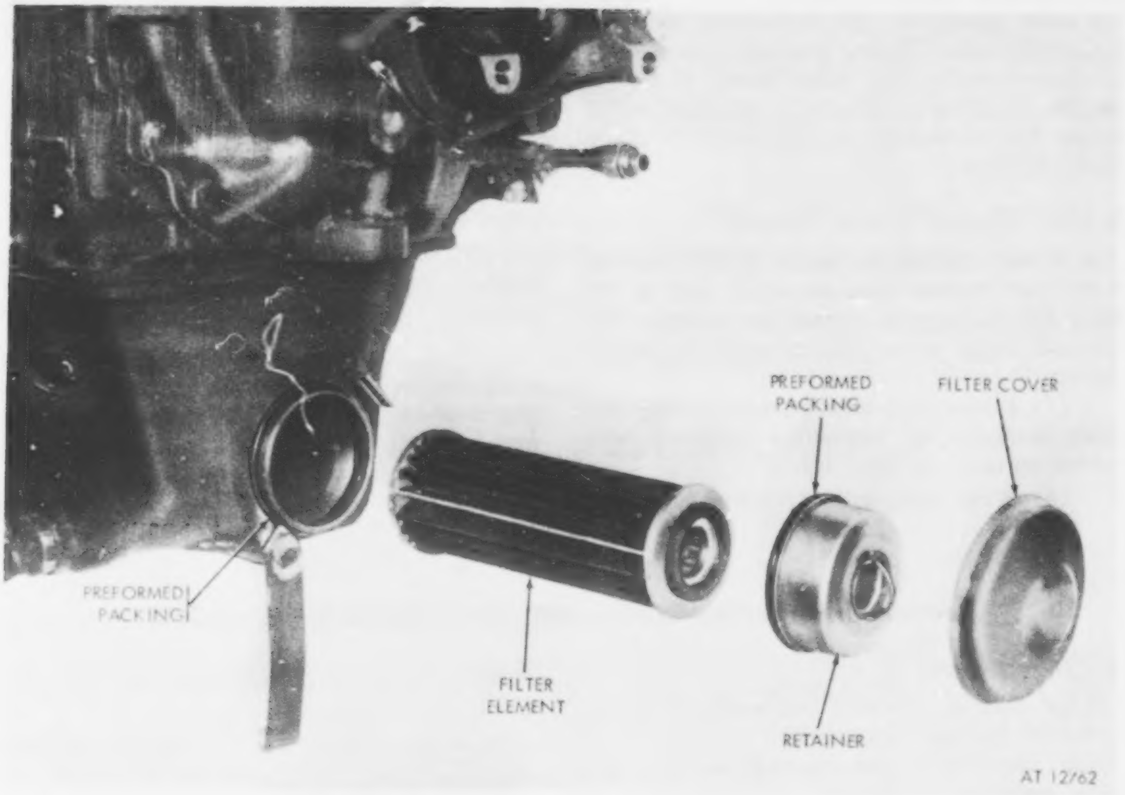

PREFORMED PACKING
FILTER COVER
PREFORMED PACKING
FILTER ELEMENT
RETAINER
AT 12762

Figure 2-239. Transmission oil filter, filter retainer and cap.

(6) Discard two preformed packings and filter element.

b. Installation.

(1) Install new filter element and two preformed packings after wiping filter cavity clean with lint-free cloth.

(2) Refer to removal procedures and reverse sequence.

(3) Refer to LO 9-2320-230-12 and refill transmission with 19 quarts (OE) oil.

2-128. Transmission Oil Cooler Thermostat

a. Removal.

(1) Remove lock wire securing thermostat valve to thermostat housing (fig. 2-240).

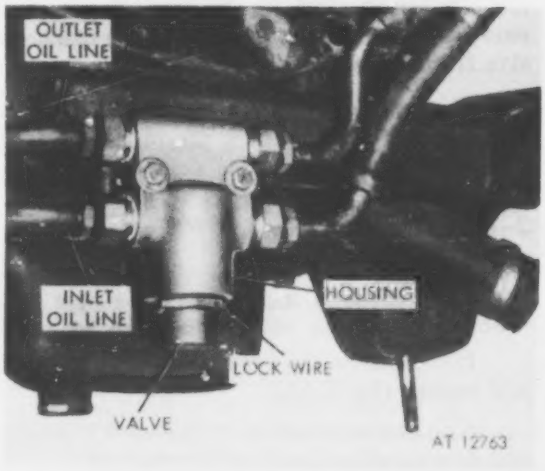

OUTLET OIL LINE
INLET OIL LINE
HOUSING
LOCK WIRE
VALVE
AT 12763

Figure 2-240. Transmission oil cooler thermostat housing and oil lines.

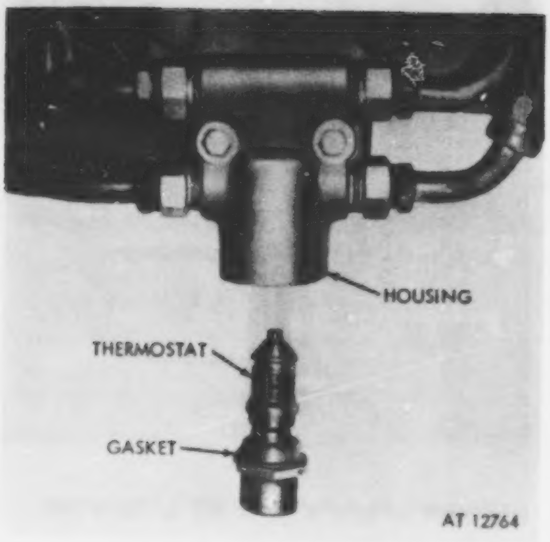


Figure 2-241. Transmission oil cooler thermostat.

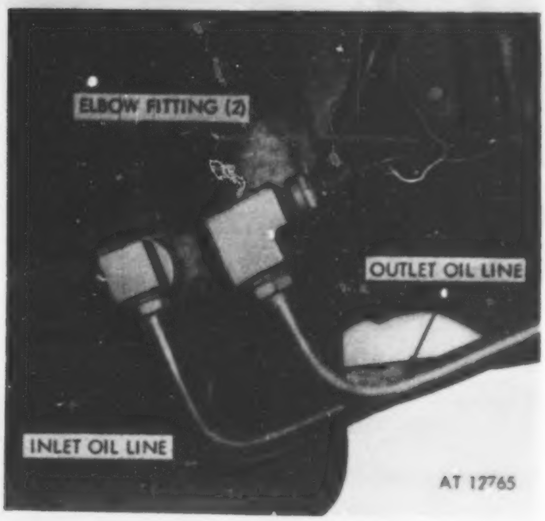


Figure 2-242. Transmission oil lines and fittings.

(2) Remove thermostat valve and gasket from thermostat housing (fig. 2-241), and drain in suitable container.

(3) Inspect thermostat valve gasket for damage and deterioration. Replace if necessary.

(4) Inspect thermostat valve, replace if valve is visually damaged.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Refer to LO 9-2320-230-12 and refill transmission with (OE) oil to proper level.

2-129. Transmission Oil Lines

a. Removal.

(1) Remove transmission drain plug and gasket and drain oil in suitable container. If copper plug gasket is damaged or deteriorated, replace gasket.

(2) After oil has drained, replace gasket and plug. Tighten plug.

(3) Disconnect transmission oil outlet and inlet lines from right side of transmission housing (fig. 2-242).

(4) Disconnect transmission outlet and inlet lines from transmission thermostat housing (fig. 2-240).

(5) Remove screw, lockwasher and nut securing transmission outlet and inlet oil line clamps. Remove oil lines.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Refer to LO 9-2320-230-12 and refill transmission with (OE) oil to proper level.

2-130. Transmission Oil Cooler Oil Lines

a. Removal.

(1) Remove selector shift knob.

(2) Remove engine front and rear hatch covers. Refer to paragraph 2-36.

(3) Disconnect oil cooler inlet and oulet lines from oil cooler thermostat housing (fig. 2-243).

(4) Disconnect oil cooler inlet and outlet

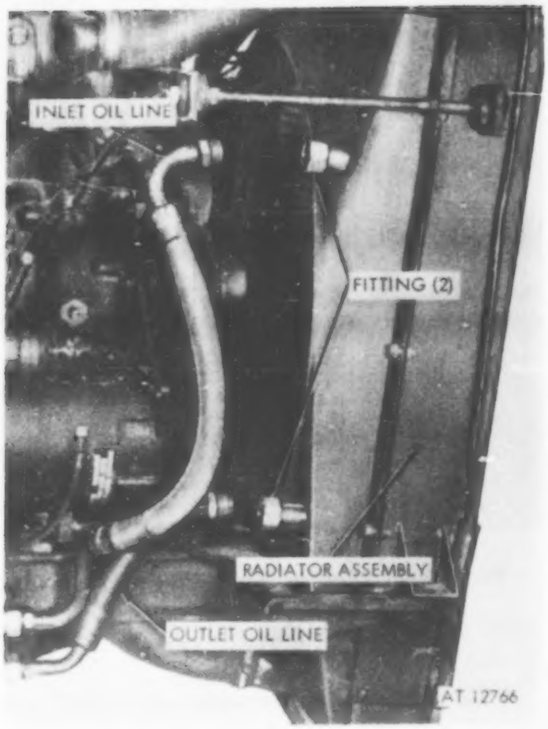

INLET OIL LINE
FITTING (2)
RADIATOR ASSEMBLY
OUTLET OIL LINE
AT 12766

Figure 2-243. Transmission oil cooler lines and fittings.

lines from transmission oil cooler (fig. 2-243). Remove lines.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

***Caution:* Make sure oil cooler lines do not kink while tightening.**

(2) Refer to LO 9-2320-230-12 and refill transmission with (OE) oil to proper level.

2-131. Transmission Selector Rods and Linkages

a. Removal.

(1) Remove shift selector knob.

(2) Remove engine front and rear hatch covers. Refer to paragraph 2-36.

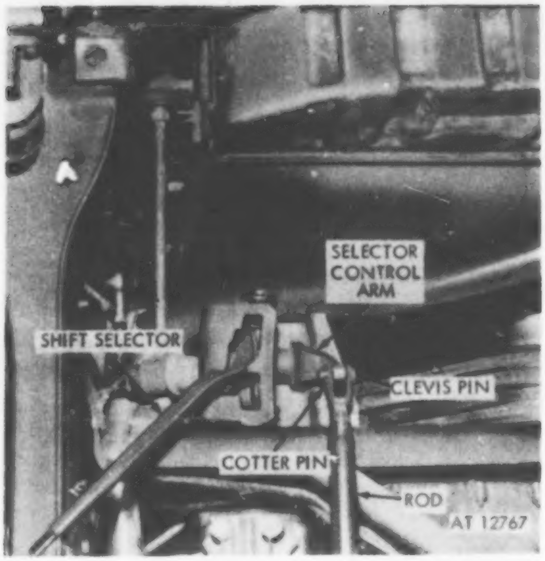

SELECTOR CONTROL ARM
SHIFT SELECTOR
CLEVIS PIN
COTTER PIN
ROD
AT 12767

Figure 2-244. Transmission shift selector and control rod.

(3) Remove cotter pin and clevis pin securing shift selector rod to selector control arm (fig. 2-244).

(4) Remove cotter pin and clevis pin securing shift selector rod to transmission shift idler lever mounted to side of engine. Remove shift selector rod (fig. 2-245).

(5) Remove cotter pin and clevis pin securing transmission selector rod to transmis-

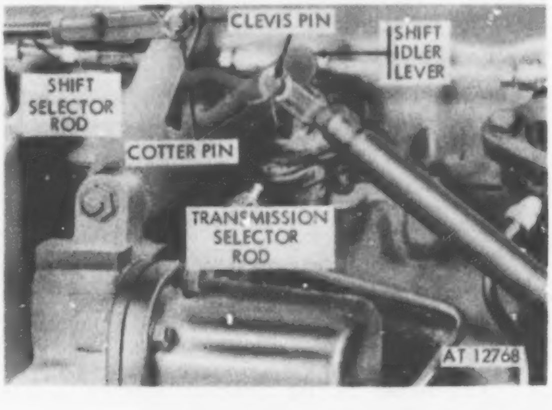

CLEVIS PIN
SHIFT IDLER LEVER
SHIFT SELECTOR ROD
COTTER PIN
TRANSMISSION SELECTOR ROD
AT 12768

Figure 2-245. Transmission selector rods and transmission shift idler lever.

sion shift idler lever mounted to side of engine (fig. 2-245).

(6) Remove cotter pin and clevis pin securing transmission selector rod to range selector arm on left side of transmission (fig. 2-246). Remove transmission selector rod.

b. *Installation*. Refer to removal procedures and reverse sequence.

2-132. Adjustment of Shift Selector Linkage

Note. Move shift selector lever from 1-2 detent position to R detent position. Selector lever should move freely and should not bind or strike quadrant when shifting. If adjustment is required, proceed as follows.

a. Remove shift selector knob and pointer.

b. Remove front and rear engine hatch covers. Refer to paragraph 2-36.

c. Place transmission shift selector in neutral position.

d. To adjust transmission shift selector rod (fig. 2-245), loosen locknut and remove clevis pin from clevis. Rotate range selector lever on the transmission one notch from the extreme clockwise position. Adjust the clevis until the pin can be inserted in the holes of the clevis and idler arm. Tighten locknut and install the cotter pin. Recheck shift selector linkage adjustment as directed above.

e. Install front and rear hatch covers. Refer to paragraph.

f. Replace shift selector knob and pointer.

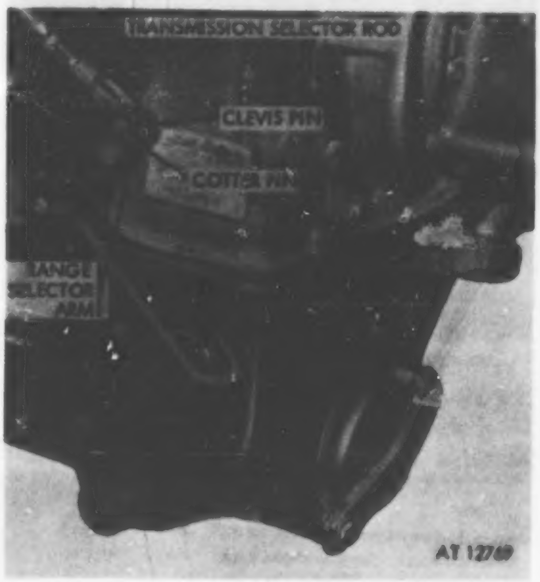


Figure 2-246. Transmission range selector arm and control rod.

Section XXIII. TRANSFER ASSEMBLY

2-133. General

This section contains a general description, service instructions, removal and installation procedures for the transfer case assembly, and transfer case mounts.

2-134. Description

The transfer is a single speed unit with one input and two output shafts. It is mounted between the frame side rails to the rear of the transmission and is connected to the transmission by a propeller shaft. The transfer is connected to the front and rear bogie axles by propeller shafts. The transfer has three control positions: neutral, rear axles and all axles. An air shift mechanism is mounted to the front side of the transfer housing. The speedometer cable is attached on the rear side of the transfer assembly. The vehicle handbrake asembly is mounted on the rear side of the transfer assembly.

2-135. Transfer Case Service

Refer to LO 9-2320-230-12 for service of the transfer case.

2-136. Transfer Case Assembly

a. *Removal.*

(1) Disconnect speedometer cable from

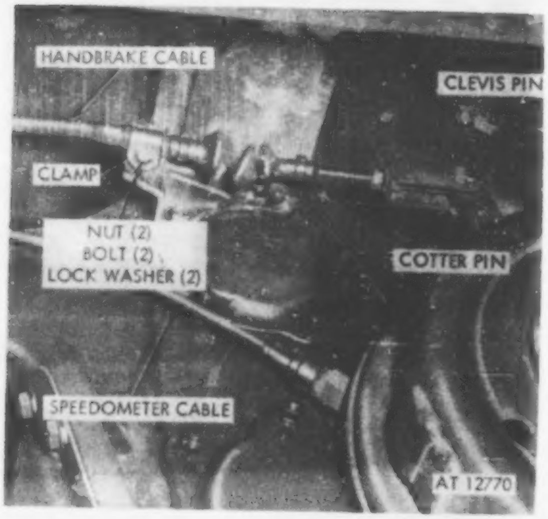

HANDBRAKE CABLE
CLEVIS PIN
CLAMP
NUT (2)
BOLT (2)
LOCK WASHER (2)
COTTER PIN
SPEEDOMETER CABLE
AT 12770

Figure 2-247. Speedometer and handbrake cables.

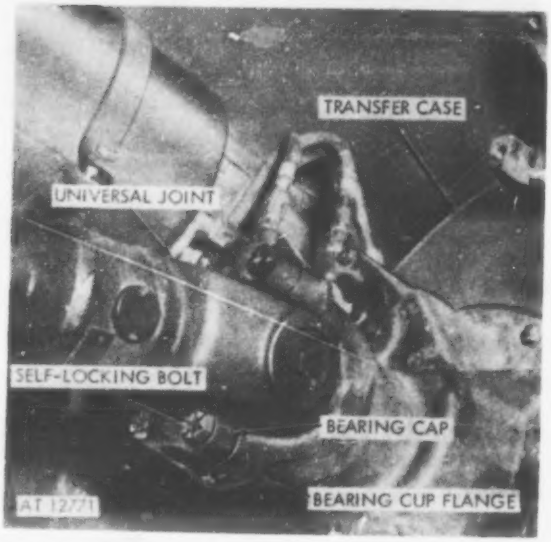

TRANSFER CASE
UNIVERSAL JOINT
SELF-LOCKING BOLT
BEARING CAP
BEARING CUP FLANGE
AT 12771

Figure 2-248. Transfer case input flange and propeller shaft.

adapter on rear of transfer (fig. 2-247). Secure cable to frame rail.

(2) Remove cotter pin and clevis pin securing handbrake cable to brake arm (fig. 2-247).

(3) Remove two nuts, bolts, and lockwashers securing brake cable clamp to transfer case (fig. 2-247). Secure cable to frame rail.

(4) Remove 12 self-locking bolts and 6 bearing caps (fig. 2-248) securing three propeller shafts to the transfer. Disconnect pro-

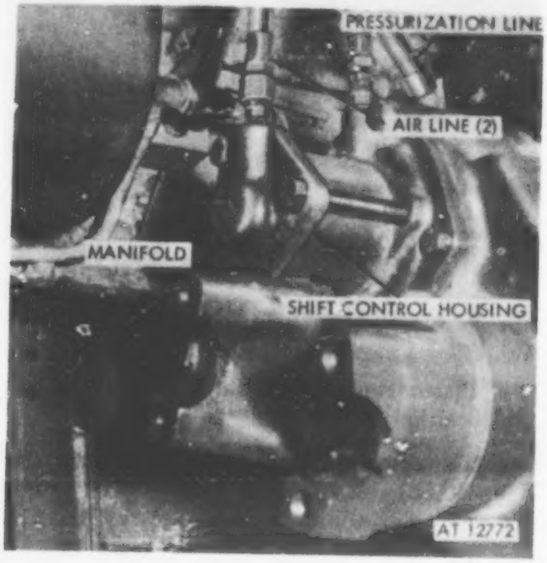

PRESSURIZATION LINE
AIR LINE (2)
MANIFOLD
SHIFT CONTROL HOUSING
AT 12772

Figure 2-249. Transfer shift air lines and case pressurization line.

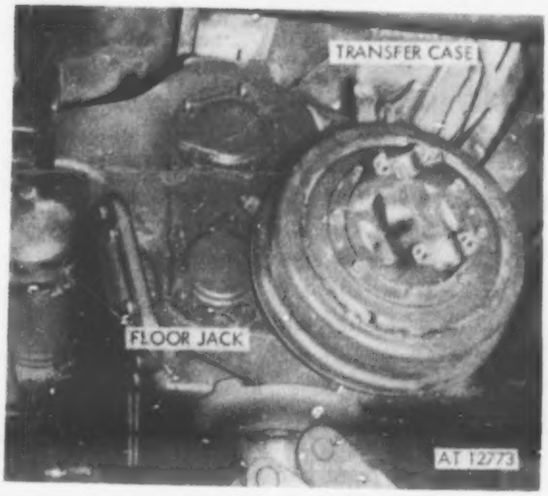

TRANSFER CASE
FLOOR JACK
AT 12773

Figure 2-250. Jack supporting transfer case.

peller shafts from transfer and tape bearing cups to universal joint crosses.

(5) Secure propeller shafts to frame rail.

(6) Disconnect forward two air lines from clutch shift control housing at housing and plug lines and fittings to prevent entry of dirt (fig. 2-249).

(7) Disconnect pressurization line from manifold mounted on frame. Plug line and fitting to prevent entry of dirt.

(8) Place suitable jack under transfer case and support weight (fig. 2-250).

(9) Remove four nuts and lockwashers securing transfer to upper mounting bracket (fig. 2-251).

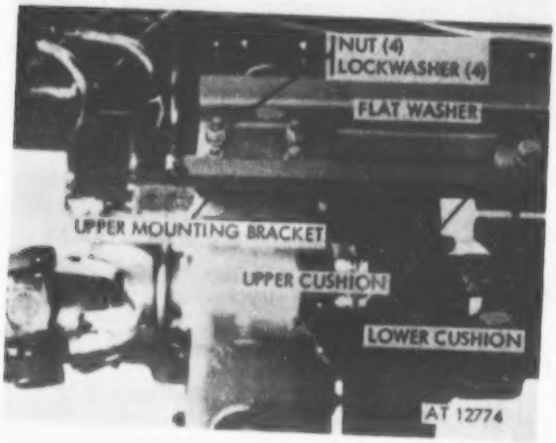

NUT (4)
LOCKWASHER (4)
FLAT WASHER
UPPER MOUNTING BRACKET
UPPER CUSHION
LOWER CUSHION
AT 12774

Figure 2-251. Transfer upper mounting bracket.

(10) Remove eight bolts and lockwashers securing right and left mounting bracket to transfer (fig. 2-252).

(11) Carefully lower transfer and remove from under vehicle.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

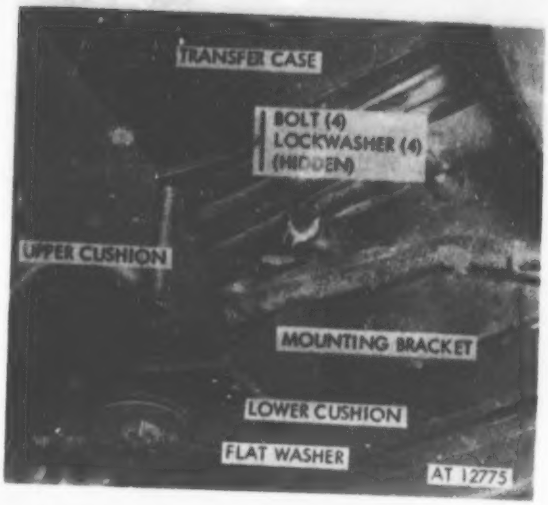

TRANSFER CASE
BOLT (4)
LOCKWASHER (4)
(HIDDEN)
UPPER CUSHION
MOUNTING BRACKET
LOWER CUSHION
FLAT WASHER
AT 12775

Figure 2-252. Transfer right mounting bracket.

(2) Prior to assembly of universal joint, clean bearing caps and yoke. Position universal joint bearing cups as shown in figure 2-256.

(3) Tighten propeller shaft universal joint cap bolts to 90-100 lb-ft.

2-137. Transfer Mounting Cushion

Note. The transfer upper and side mounting cushions are removed and installed in a similar manner.

a. Removal of Mounting Cushions.

(1) Remove cotter pin, nut, flat washer, rubber cushion and bolt from right, left, and upper transfer case mounting brackets (figs. 2-251 and 2-252).

(2) Use suitable jack to raise transfer case a sufficient distance to facilitate removal of other mounting cushions (fig. 2-251 and 2-252).

b. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Tighten mounting bolt nuts to 90-100 lb-ft.

Section XXIV. PROPELLER SHAFTS

2-138. General

This section contains replacement procedures for the vehicle power train propeller shafts (fig. 2-253) and repair procedures for the universal joints. Because of the similarity between the propeller shafts, replacement and repair instructions cover one typical shaft assembly.

a. Propeller Shafts. The five power train propeller shafts are equipped with two universal joints and one slip joint. Each end of propeller shaft is connected to yokes on drive and

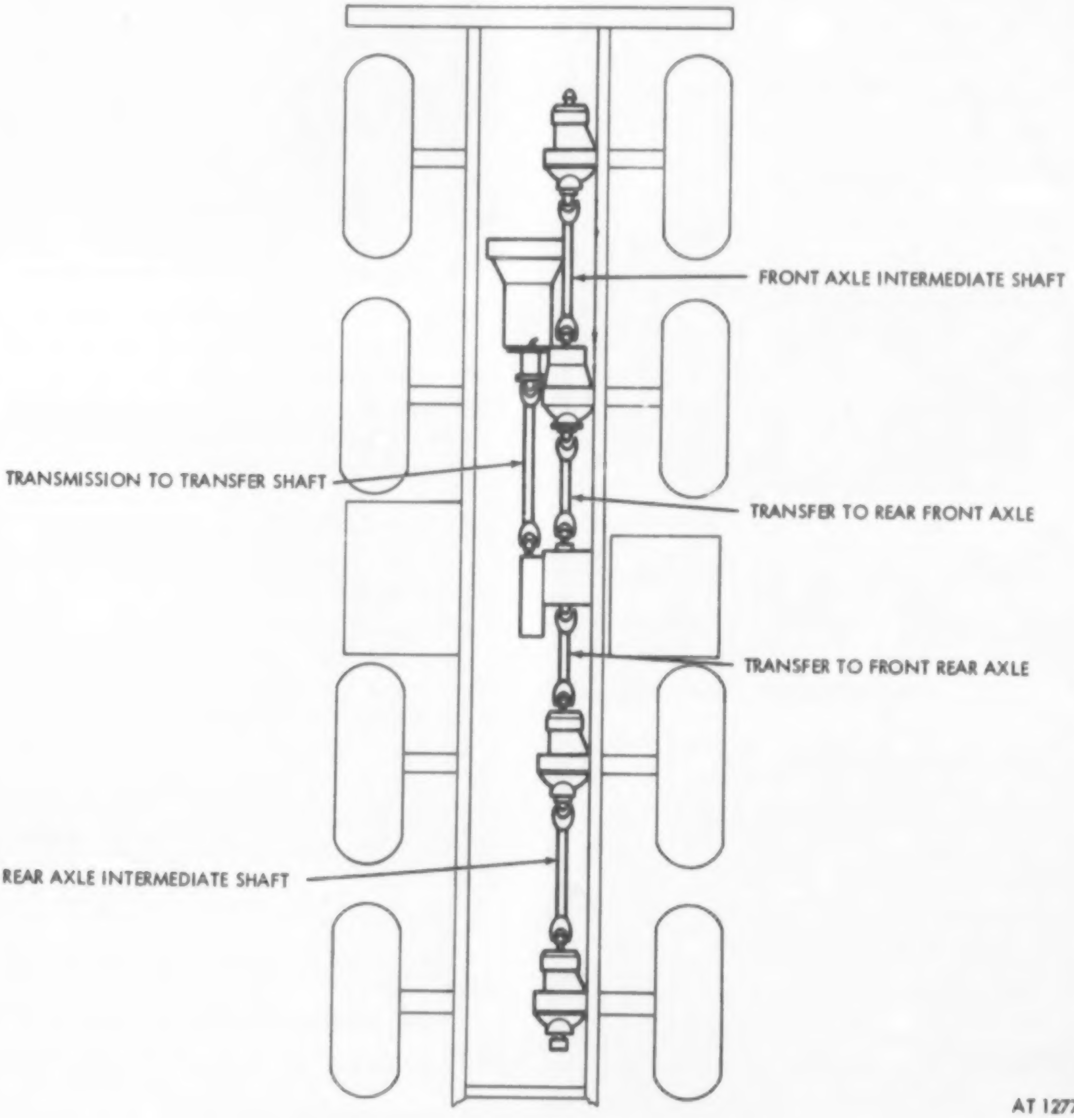

FRONT AXLE INTERMEDIATE SHAFT
TRANSMISSION TO TRANSFER SHAFT
TRANSFER TO REAR FRONT AXLE
TRANSFER TO FRONT REAR AXLE
REAR AXLE INTERMEDIATE SHAFT
AT 12776

Figure 2-253. Vehicle power train propeller shafts.

driven components with two bearing caps and four self-locking capscrews.

b. Universal Joints. There are two basic methods of securing the universal joint cross bearing cups, the snapring method on propeller shafts and the bearing cap method for yokes.

c. Slip Joint. Each propeller shaft has one slip joint. When the splines of the sleeve yoke and shaft (fig. 2-254) show excessive wear, the propeller shaft should be replaced.

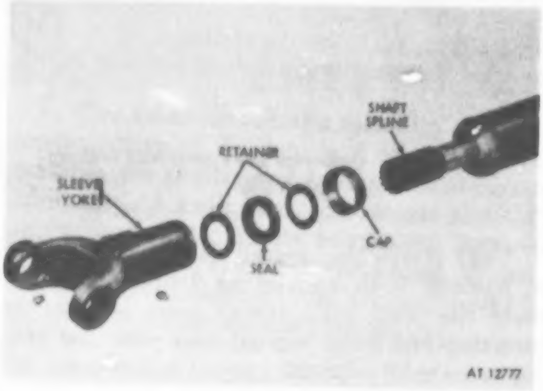


Figure 2-254. Propeller shaft slip joint assembly.

2-139. Propeller Shafts

a. Service. For service procedures on the five vehicle power train propeller shafts, refer to LO 9-2320-230-12.

b. Removal.

***Warning:* Before removing a propeller shaft, place vehicle on level surface and place chocks under wheels to prevent movement of vehicle.**

(1) Support propeller shaft and remove eight self-locking capscrews and four bearing caps securing four bearing cups (fig. 2-255) to component input and output yokes (fig. 2-256).

(2) Remove propeller shaft assembly and tape bearing cups on journals of the crosses.

c. Installation.

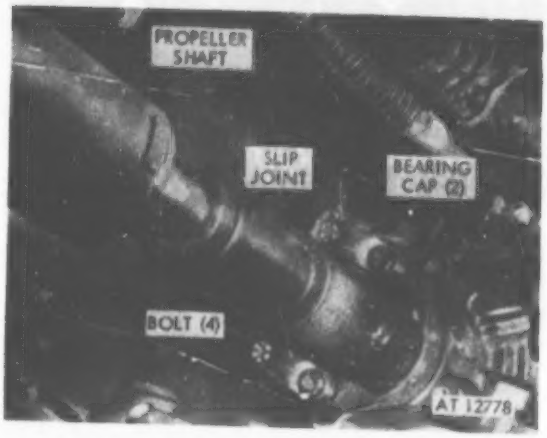


Figure 2-255. Propeller shaft markings and bearing caps and mounting flange.

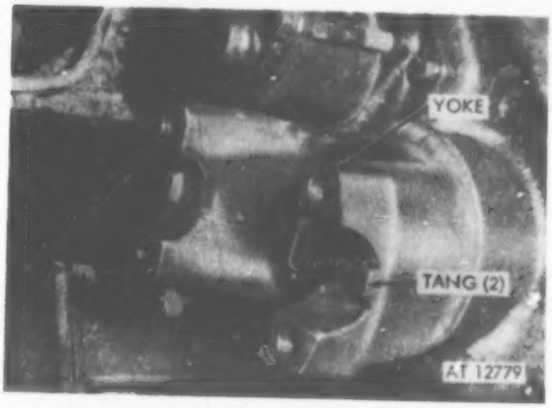


Figure 2-256. Propeller shaft bearing cap and mounting flange bosses.

(1) Position universal joint bearing cups between the tangs of the yokes with the flats on the cups adjacent to the tangs (fig. 2-256).

Note. Install all propeller shafts with the slip joint to forward end of shaft.

(2) Position four bearing caps on bearing cups (fig. 2-256). Secure caps with eight self-locking capscrews.

(3) Tighten self-locking capscrews to 90-100 lb-ft.

2-140. Universal Joints

a. General. Universal joints must be replaced whenever excessive wear is indicated by looseness in bearings between the journal and yoke. Repair kits are available for maintenance of universal joints.

b. Removal. Remove propeller shaft (para 2-139).

c. Replacement.

(1) *Disassembly.* Remove retaining ring from each end of cross (fig. 2-257). Remove lubricating fitting. Drive cross until bearing cup is exposed from yoke. Grasp with channel lock pliers and remove from yoke. Tap exposed end of cross journal until second bearing is driven from yoke. Remove cross by moving it to one side as far as possible and tilting to clear side of yoke. Repeat procedure to remove cross from other yoke. Discard bearing and cross assembly.

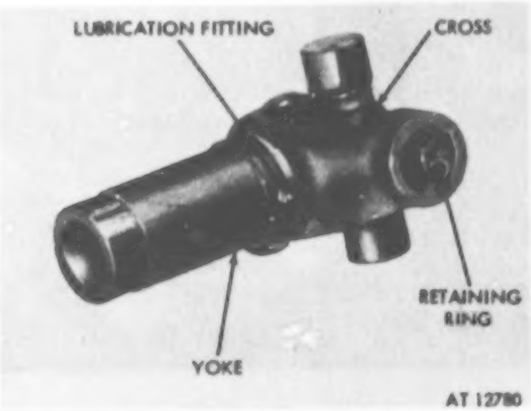

LUBRICATION FITTING
CROSS
RETAINING RING
YOKE
AT 12780

Figure 2-257. Propeller shaft yoke journal bearing and snapring.

(2) *Cleaning.* Clean all parts in mineral spirits paint thinner or dry-cleaning solvent. Make sure all parts are thoroughly cleaned of grease, dirt and grit. When necessary, soak parts in solvent and brush with stiff brush to remove caked grease. Dry parts thoroughly with compressed air. Cover until ready for installation.

(3) *Inspection and repair.* Inspect yokes for cracks, wear, or bent condition. Clean slight nicks or burs with fine stone. Replace universal joint (fig. 2-258).

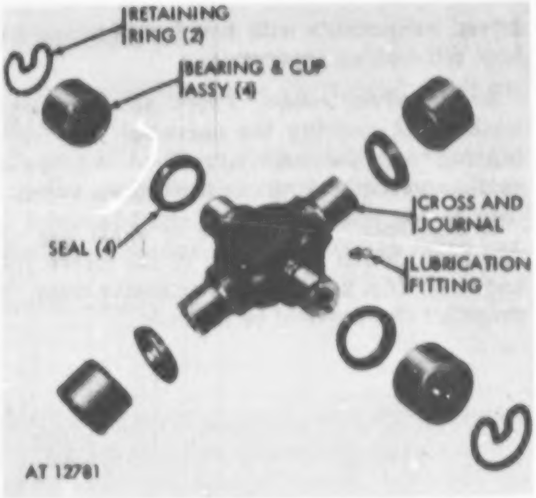

RETAINING RING (2)
BEARING & CUP ASSY (4)
CROSS AND JOURNAL
SEAL (4)
LUBRICATION FITTING
AT 12781

Figure 2-258. Universal joint cross and bearing assembly.

(4) *Assembly.* Install lubricating fitting in journal. With lubricating fitting facing toward the shaft yoke, install cross in yoke by inserting one cross journal into yoke and tilting cross until opposite journal enters yoke. Insert bearings in yoke with flat surface on bearing cup alined with flat in yoke opening (fig. 2-259) and over journals and press into place using vise. With bearings in position, install new snaprings in yoke making sure that rings seat properly in yoke grooves (fig. 2-259). If joint appears to bind, tap snapring ends of

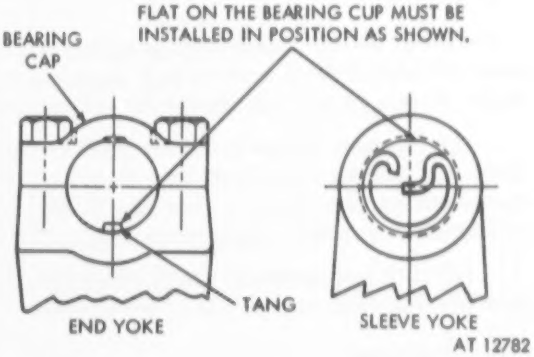

BEARING CAP
FLAT ON THE BEARING CUP MUST BE INSTALLED IN POSITION AS SHOWN.
TANG
END YOKE
SLEEVE YOKE
AT 12782

Figure 2-259. Bearing cup position.

bearings lightly to relieve pressure of bearings on ends of journal.

d. Installation. Refer to paragraph 2–139 for installation instructions.

Section XXV. FRONT AXLE

2–141. General

a. This section contains procedures for the removal and installation of the following front axle components: thru shaft input and output yokes and seals, axle shafts and C–V joint assemblies, sealed brake assembly, steering knuckle housing, housing bushings and boot, and steering arm. In addition, instructions for repair of the sealed brake assembly and service procedures for the axle assembly are included.

b. Two front drive axles make up the front tandem drive of the vehicle. The two axle assemblies are similar and have identical carrier (differential) assemblies, axle shafts and C–V joints, and sealed brake assemblies. Removal and installation are identical except as indicated in the following instructions. Refer to LO 9–2320–12 for service instructions.

2–142. Differential Input and Output Yokes

The following procedures may be accomplished without removing axle assemblies or differential housings from the vehicle. The input and output yokes are removed in the same manner.

a. Removal.

(1) Remove propeller shaft from yoke to be replaced as directed in paragraph 2–139.

(2) Remove cotter pin from yoke center nut (fig. 2–260).

(3) Install holding wrench (11600926) on yoke end using existing bearing cap bolts (fig. 2–261).

(4) Remove nut and flat washer retaining yoke to differential thru shaft.

(5) Remove holding tool from yoke.

(6) Scribe mark on end of thru shaft and

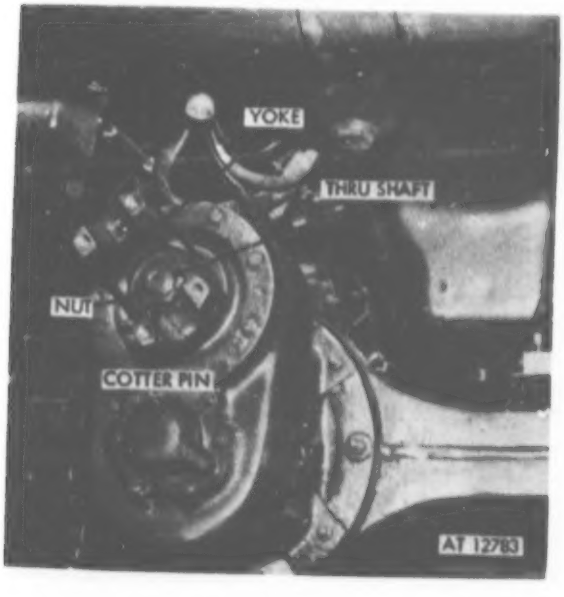


Figure 2–260. Differential thru shaft yoke, nut and cotter pin.

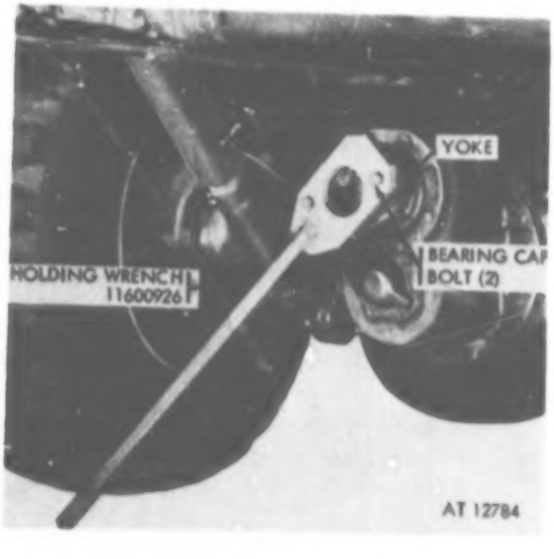


Figure 2–261. Installation of holding wrench (11600926) on thru shaft yoke.

yoke so that yoke may be positioned correctly during installation procedures.

(7) Remove yoke from thru shaft and differential housing.

c. Installation. Before replacing either the front or rear thru shaft yoke, the thru shaft seal assembly must be replaced. Refer to paragraph 2–143*a* for replacement of the front thru shaft seal assembly and to paragraph 2–143*b* for replacement of the rear thru shaft seals assembly.

(1) Lubricate oil seal and yoke splines lightly with GAA type lubricant.

(2) Place yoke on thru shaft splines with scribe marks alined (fig. 2–262).

Note. The input and output (front and rear) yokes must be positioned on same plane.

(3) Position flat washer on shaft end and install nut. Using holding wrench (11600926) (fig. 2–261) and socket wrench, tighten nut to 300–400 lb–ft.

Note. Aline castle nut slots with cotter pin hole in shaft while tightening nut between 300–400 lb.-ft.

(4) Remove holding wrench and install cotter pin.

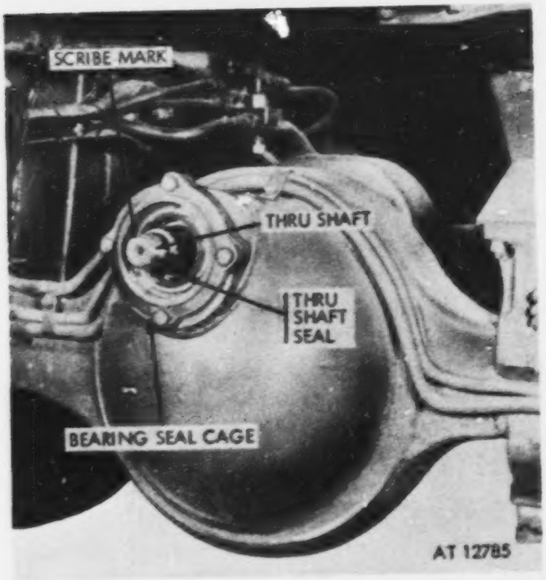

SCRIBE MARK
THRU SHAFT
THRU SHAFT SEAL
BEARING SEAL CAGE
AT 12785

Figure 2–262. Differential thru shaft and bearing seal cage.

(5) Install propeller shaft on yoke as directed in paragraph 2–139*b*.

2–143. Differential Thru Shaft Seal Assembly Replacement

Sealing of the differential thru shaft is accomplished by an inner seal in the bearing cage and an outer seal on the diameter face of the splined yoke (fig. 2–263). The cages which

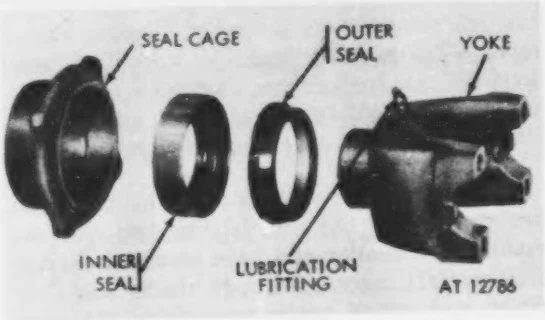

SEAL CAGE
OUTER SEAL
YOKE
INNER SEAL
LUBRICATION FITTING
AT 12786

Figure 2–263. Bearing, seal cage, seals and yoke.

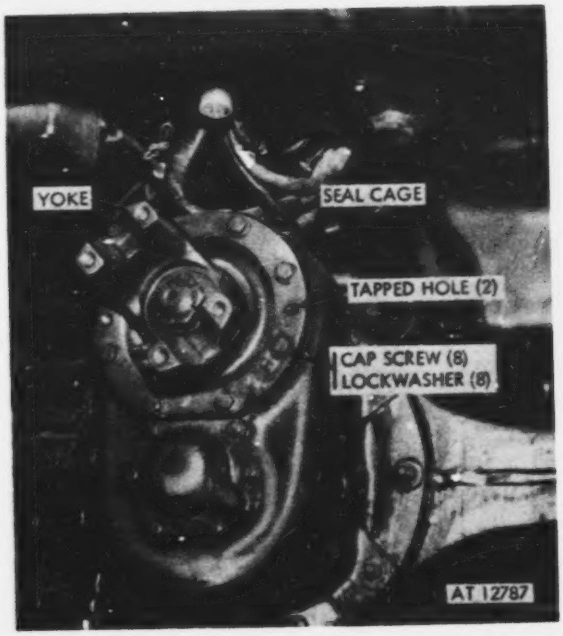

YOKE
SEAL CAGE
TAPPED HOLE (2)
CAP SCREW (8)
LOCKWASHER (8)
AT 12787

Figure 2–264. Thru shaft front yoke and bearing seal cage.

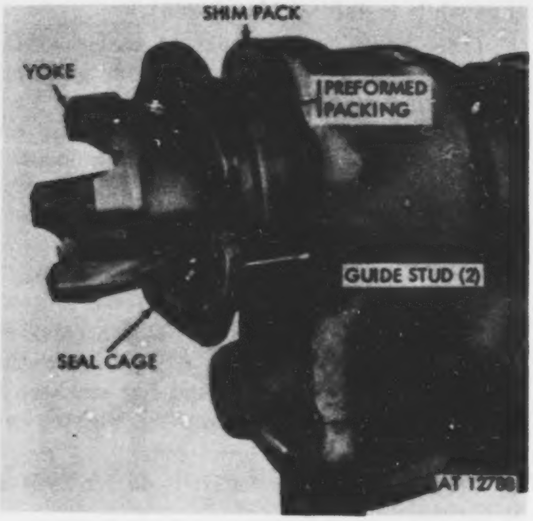

SHIM PACK
YOKE
PREFORMED PACKING
GUIDE STUD (2)
SEAL CAGE
AT 1278

Figure 2-265. Seal cage and differential housing.

retain the inner oil seals at each end of the thru shaft are mounted differently. Directions for replacement of cage seals are covered separately as follows:

a. Front Thru Shaft Assembly Replacement.

(1) Remove front yoke from thru shaft as directed in paragraph 2-142*a*.

(2) Remove eight capscrews and flat washers retaining front bearing seal cage to differential housing (fig. 2-264).

(3) Use two puller screws (7/16 x 14 2-1/2") in tapped holes provided in seal cage (fig. 2-264) to loosen and remove cage from housing.

(4) Remove and retain shim pack located between seal cage and differential housing (fig. 2-265) so that shims can be reinstalled exactly as they were removed.

(5) Use suitable tool to remove and discard inner seal from cage.

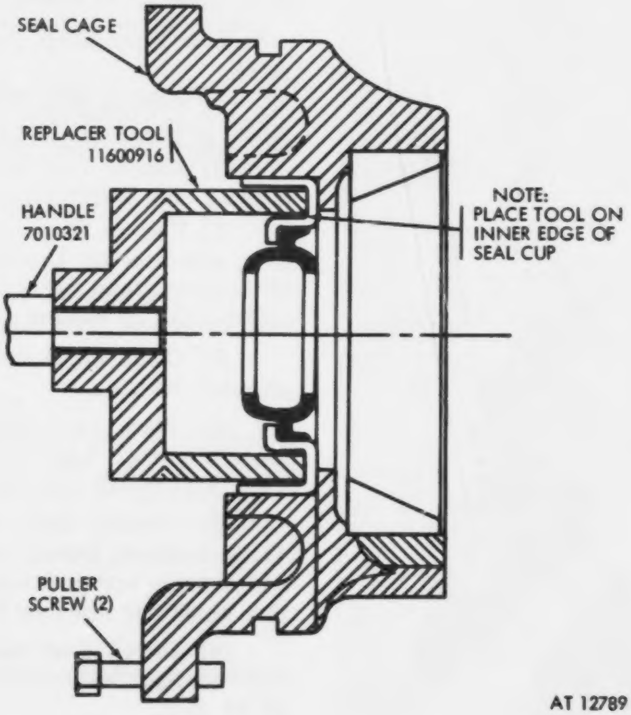

SEAL CAGE
REPLACER TOOL 11600916
HANDLE 7010321
NOTE: PLACE TOOL ON INNER EDGE OF SEAL CUP
PULLER SCREW (2)
AT 12789

Figure 2-266. Thru shaft oil seals.

best copy available

Reproduced from poor document.

(6) Remove preformed packing from around outer diameter of cage (fig. 2-265).

(7) Remove outer seal from yoke.

(8) Clean all sealer material from cage and differential housing. Clean yoke and seal cage in dry-cleaning solvent or mineral spirits paint thinner. Dry parts with compressed air.

(9) Install new preformed packing in groove around outer diameter of seal cage (fig. 2-265).

(10) Position new inner seal on cage and install seal using replacer tool (11600916) and handle (7010321) (fig. 2-266).

(11) Position new outer seal on yoke and install seal using replacer tool (11600918) and handle (7010321) (fig. 2-267).

(12) Install two guide studs (7/16 x 14 x 3") in cage mounting screw holds to guide cage while installing (fig. 2-265).

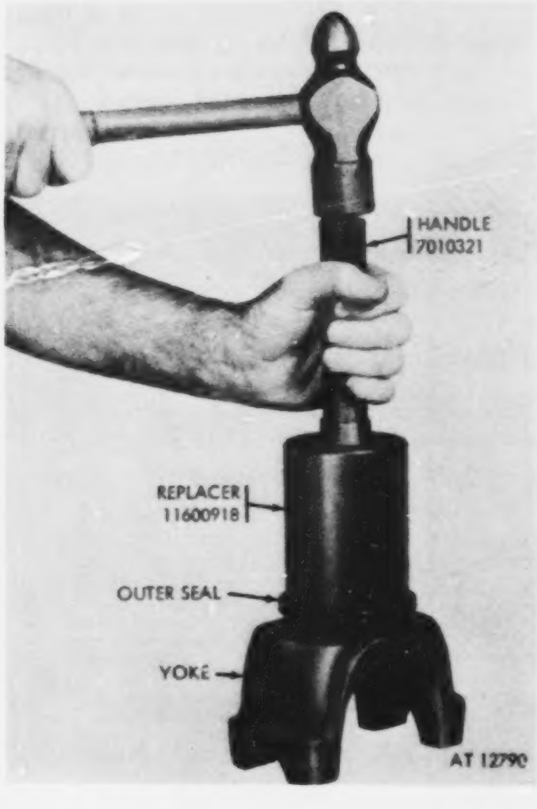


Figure 2-267. Replacing outer oil seal on yoke.

(13) Apply a light coat of sealer (MIL-S-45180, type II) to original shim pack and surface of cage and differential housing. Position shim pack and cage on guide studs, and using yoke as guide, force cage into housing using yoke as guide, force cage into housing using care not to damage oil seal or distort preformed packing. Remove guide studs.

Note. Original shim pack must be reinstalled to maintain correct thru shaft end play (0.001 to 0.005).

(14) Apply a light coat of sealer (MIL-S-45180, type II) to threads of eight mounting capscrews. Use capscrews and flat washers to secure cage to differential housing. Tighten capscrews to 53-67 lb-ft.

(15) Apply sealer (MIL-S-45180, type I) to housing and cage.

(16) Install front yoke as directed in paragraph 2-142*c*.

(17) Lubricate thru shaft seals at fittings as directed in LO 9-2320-230-12.

b. Rear Thru Shaft Seal Assembly Replacement.

(1) Remove yoke from thru shaft as directed in paragraph 2-142*a*.

(2) Remove four capscrews securing rear bearing cage to differential housing.

(3) Remove bearing seal cage and gasket from axle housing. Discard gasket.

(4) Use suitable tool to remove and discard inner seal from cage.

(5) Clean all gasket material from cage and axle housing.

(6) Place new inner seal on cage and using replacer tool (11600916) and handle (7010321) install seal (fig. 2-268).

(7) Install new gasket using sealer (MIL-S-45180, type II) on gasket, cage, bolts, and housing and position bearing seal cage on thru shaft and into axle housing.

(8) Install four capscrews securing seal cage to axle housing. Tighten capscrews to 27-35 lb-ft.

(9) Apply sealer (MIL-S-45180, type I) to cage and housing.

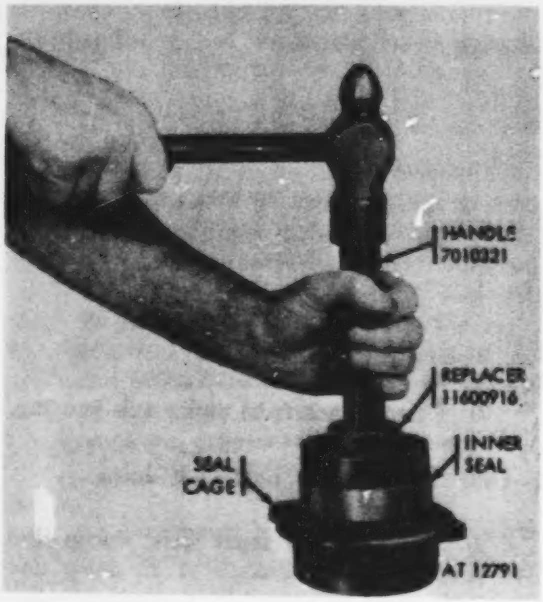

HANDLE
7010321
REPLACER
11600916
INNER
SEAL
SEAL
CAGE
AT 12791

Figure 2-268. Thru shaft rear oil seal replacement.

(10) Remove outer seal from yoke and using replacer tool (11600918) and handle (7010321) install new seal on yoke (fig. 2-267).

(11) Install rear yoke as directed in paragraph 2-139*c*.

c. Service. Lubricate thru shaft seals at fittings (fig. 2-263) as directed in LO 9-2320-230-12.

2-144. Steering Arm

a. Description. A steering arm is attached to the upper side of each left steering knuckle housing and is actuated by a steering rod to steer the front wheels of the truck. The steering arm acts as a retainer for the steering knuckle upper bushing sleeve.

b. Removal.

(1) Place jack under axle housing and relieve weight on tires.

(2) Turn truck wheels to the left until steering rod ball joint nut is not obstructed by

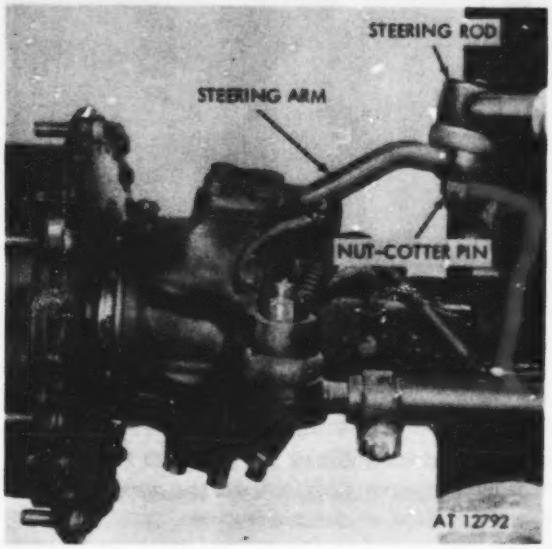

STEERING ROD
STEERING ARM
NUT-COTTER PIN
AT 12792

Figure 2-269. Steering rod ball joint and steering arm.

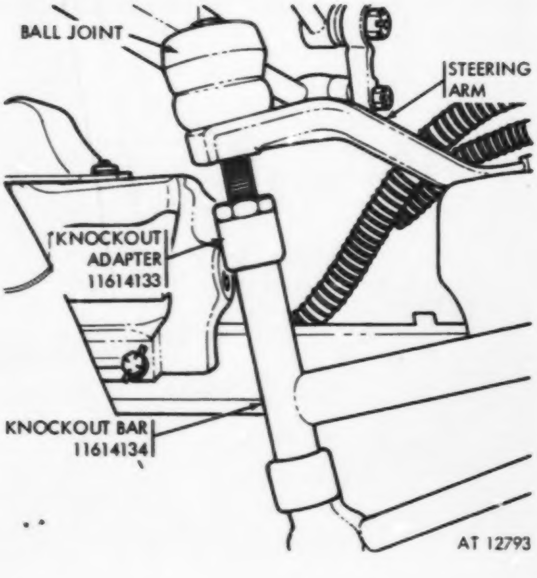

BALL JOINT
STEERING
ARM
KNOCKOUT
ADAPTER
11614133
KNOCKOUT BAR
11614134
AT 12793

Figure 2-270. Using knockout adapter (11614133) and knockout bar (11614134) to loosen ball joint.

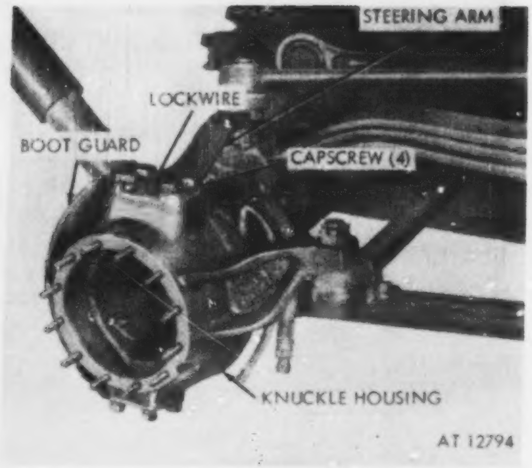


Figure 2-271. Steering knuckle housing, boot guard and steering arm.

axle housing. This will allow clearance for use of knock out adapter (11614133).

(3) Remove cotter pin and nut securing steering rod ball joint to steering arm (fig. 2-269).

(4) Use knock out adapter (11614133) to loosen steering rod ball joint from steering arm (fig. 2-270).

(5) Remove adapter and remove steering rod from steering arm.

(6) Remove lock wire and four capscrews securing steering arm and boot guard to steering knuckle. Remove steering arm (fig. 2-271).

Note. Boot guard may be pulled slightly forward when removing steering arm.

c. Installation.

(1) Position steering arm and boot guard upper steering knuckle sleeve and install four capscrews. Tighten capscrews to 325-420 lb-ft. and secure capscrews with lock wire.

(2) Place steering rod ball joint on steering arm and install nut. Tighten nut to 250-325 lb-ft. and secure with cotter pin.

(3) Remove jack from under axle housing.

2-145. Axle Shafts and C-V Joint Assembly

a. Description. The front axle shafts and C-V joint assembly consists of an outer and inner axle shaft connected by a constant velocity (C-V) joint (fig. 2-272).

b. Removal.

(1) Raise axle housing and remove wheel and tire assembly (TM 9-2320-230-10).

(2) Use jack to support weight of sealed brake assembly.

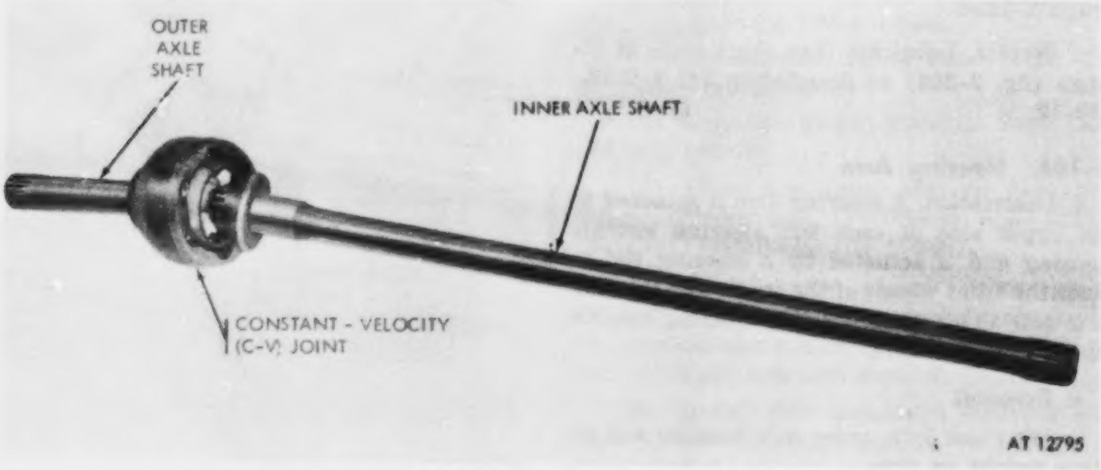


Figure 2-272. Front axle shaft assembly.

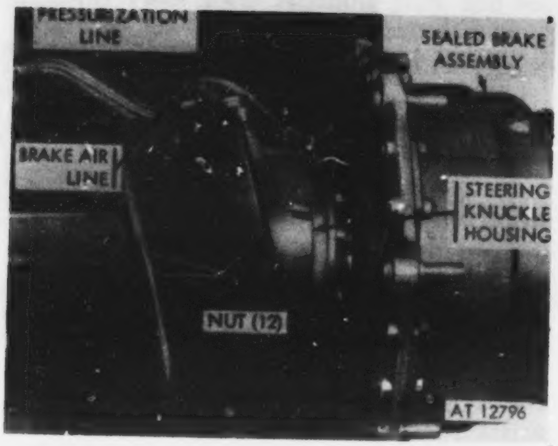


Figure 2-273. Steering knuckle and sealed brake assembly.

(3) Disconnect brake line and pressurization line from top side of wheel spindle (fig. 2-273).

(4) Remove 12 nuts securing sealed brake assembly to knuckle housing (fig. 2-273).

(5) Use soft hammer at knock out slots to separate wheel spindle from knuckle housing.

(6) Remove sealed brake assembly from axle housing (fig. 2-274).

(7) Pull axle shafts and C-V joint assembly from axle housing (fig. 2-275).

c. Installation.

(1) Clean knuckle housing and mating surfaces of wheel spindle thoroughly removing all grease and foreign material before assembling. Clean C-V joint best possible way without disassembling unit.

(2) Pack axle shafts C-V joint with GAA type lubricant (approximately 2 pounds). Apply a light coating of GAA grease on axle shaft splines.

(3) Replace inner and outer axle shaft oil seals. Refer to paragraph 2-148*d*. Remove plug from upper and lower knuckle bushing caps (fig. 2-275) and install grease fitting (MS-15003-1). Lubricate bushings with GAA type lubricant, remove fittings and reinstall plugs.

(4) Refer to removal procedure and reverse sequence and install axle shafts and C-V joint, sealed brake assembly, air lines and wheel and tire assy.

Note. Slowly rotate axle shaft while inserting in axle housing to assist in alinement of axle shaft splines with differential side gear.

2-146. Steering Knuckle Bushings

a. Description. The steering knuckle bushings are press fitted in bushing sleeves and are replaced as an assembly. When a steering knuckle bushing becomes worn or damaged both (upper and lower) sleeve and bushing assemblies must be replaced.

b. Removal.

(1) Remove axle shafts and C-V joint assembly. Refer to paragraph 2-145.

(2) If the steering knuckle bushings to be replaced are on the steering arm end of the axle housing, remove lock wire and four capscrews securing boot guard and steering arm to knuckle housing (fig. 2-276). Pull guard for-

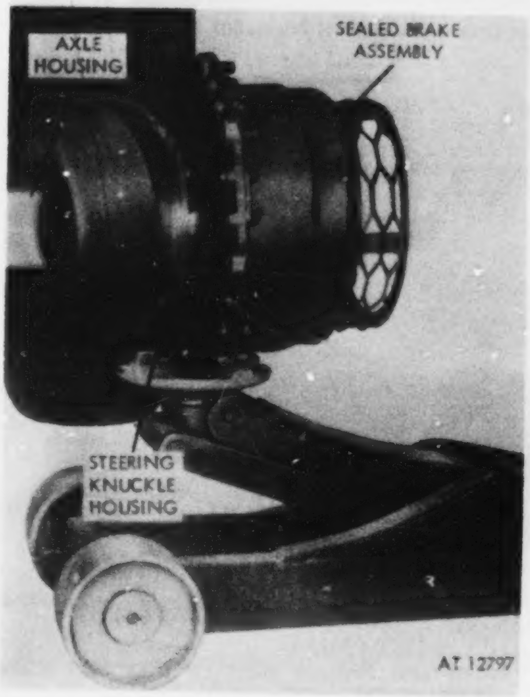


Figure 2-274. Sealed brake assembly.

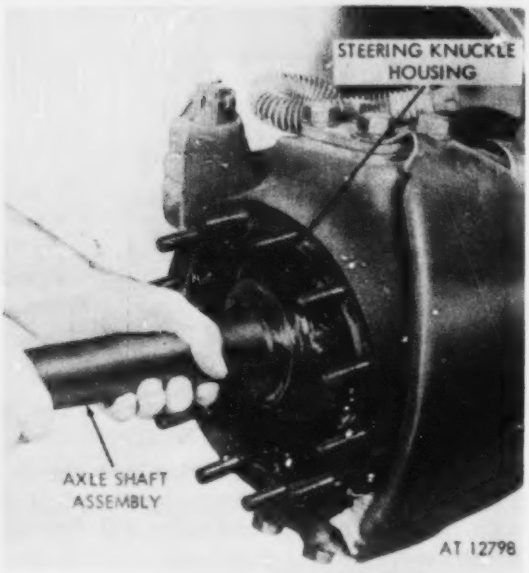

STEERING KNUCKLE HOUSING
AXLE SHAFT ASSEMBLY
AT 12798

Figure 2-275. Removing front axle shaft assembly.

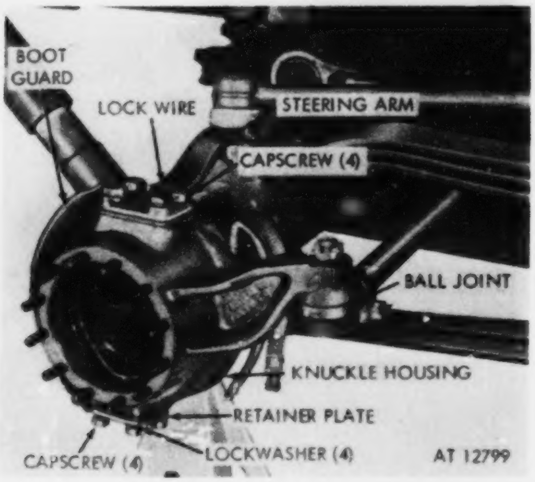

BOOT GUARD
LOCK WIRE
STEERING ARM
CAPSCREW (4)
BALL JOINT
KNUCKLE HOUSING
RETAINER PLATE
CAPSCREW (4)
LOCKWASHER (4)
AT 12799

Figure 2-276. Steering knuckle housing, installed view.

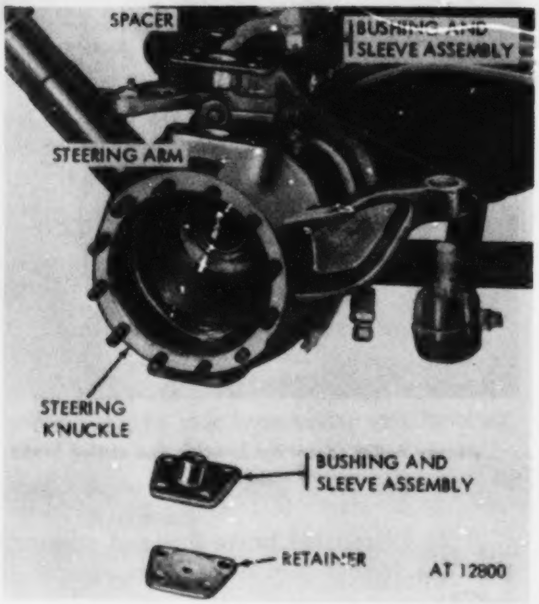

SPACER
BUSHING AND SLEEVE ASSEMBLY
STEERING ARM
STEERING KNUCKLE
BUSHING AND SLEEVE ASSEMBLY
RETAINER
AT 12800

Figure 2-277. Steering knuckle housing and bushing assemblies.

ward and remove steering arm and knuckle spacer.

(3) If the steering knuckle bushings to be replaced are on the end of the housing opposite the steering arm, remove four capscrews and lockwashers securing boot guard and upper retaining plate to knuckle housing.

(4) Remove four capscrews and lockwashers securing boot guard and lower retaining plate to knuckle housing (fig. 2-276). Remove boot guard and lower retaining plate.

(5) Remove lower sleeve and bushing assembly from knuckle housing (fig. 2-277).

(6) Remove spacer, upper sleeve and bushing assembly from knuckle housing (fig. 2-277).

c. *Installation.*

(1) Clean axle housing and knuckle housing thoroughly, removing all grease and foreign material before assembling.

(2) Coat axle housing lower pin and knuckle bushing with GAA type lubricant.

(3) Place lower sleeve and bushing assembly on axle housing lower kingpin and force sleeve into knuckle housing.

(4) Place lower retaining plate and boot guard on lower sleeve and bushing assembly and secure with four capscrews and lockwashers.

(5) Tighten capscrews to 116–149 lb-ft.

(6) Coat axle housing upper pin and knuckle bushing with GAA type lubricant.

(7) Place upper sleeve and bushing assembly on axle housing upper pin and into knuckle housing.

(8) Place jack under knuckle housing at lower retaining plate. Raise jack until lower pin bottoms on rest plate.

(9) Place spacer on upper pin making sure sleeve and bushing assembly is bottoming on knuckle housing.

(10) Place straight edge across sleeve opening and over spacer. Using feeler gage, measure space between straight edge and spacer (fig. 2–278). If measurement is between 0.005 and 0.013 inches the spacer is of correct thickness. If not, replacement spacers are available to obtain proper adjustment.

(11) After correct measurement has been obtained, replace steering arm (para 2–144) and the upper retaining plate and boot guard on knuckle housing sleeve and bushing assembly and install capscrews. Tighten capscrews to 116–149 lb-ft.

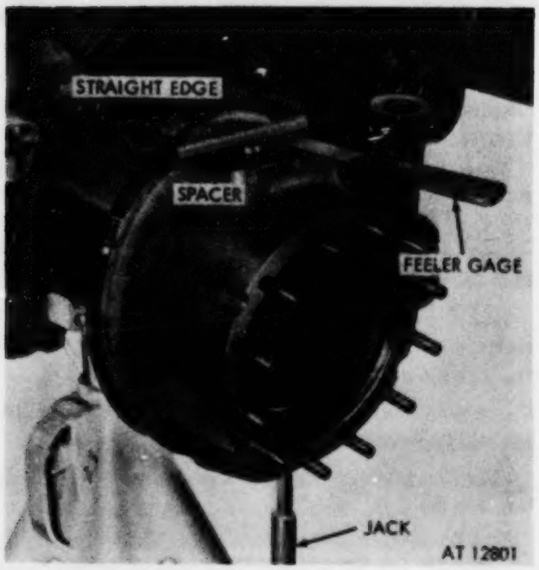


Figure 2–278. Steering knuckle adjustment.

(12) Replace axle shaft and C–V joint assembly, sealed brake, and wheel and tire assembly. Refer to paragraph 2–145*c*.

(13) Remove jack supporting axle housing.

2–147. Steering Knuckle Housing and Boot

a. Description. The knuckle housings are secured to the ends of the front axle by two king pins. Bushings and sleeves are installed in the knuckle housing and ride on the pins permitting easy turning of the knuckle assembly. A rubber boot is connected between the steering knuckle housing and the axle housing to prevent water, dust and mud from entering the knuckle housing and axle. The boot is protected on the front side of the axle by a guard attached to the steering knuckle housing. The right and left knuckle housings and dust boots are removed and installed in the same manner.

b. Removal.

(1) Remove axle shafts and C–V joint (para 2–145*b*).

(2) Remove cotter pin and nut securing

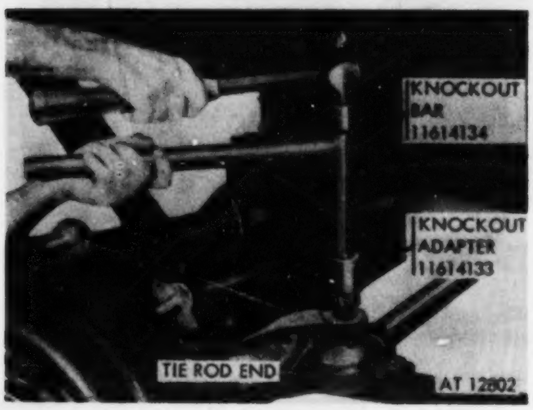


Figure 2–279. Using adapter (11614133) and knockout bar (11614134) to loosen tie rod ball joint.

tie rod ball joint to knuckle housing arm (fig. 2-276).

(3) Use knockout adapter (11614133) and knockout bar (11613134) to loosen tie rod ball joint from knuckle arm (fig. 2-279).

(4) Remove knockout adapter and remove tie rod end from knuckle arm.

(5) Remove upper and lower knuckle sleeve and bushing assemblies. Refer to paragraph 2-146*b*.

(6) Remove knuckle boot outer clamp screw and nut (fig. 2-280). Slip clamp and boot off knuckle housing.

(7) Remove knuckle housing boot inner clamp screw and nut (fig. 2-281). Slip clamp and boot off end of axle housing.

(8) Raise and tilt steering knuckle over upper axle housing pin. Remove knuckle housing.

c. Installation.

(1) Thoroughly clean end of axle housing, axle shaft and C-V joint assembly, and steering knuckle with suitable cleaning compound. Wipe dry with clean lint-free cloth.

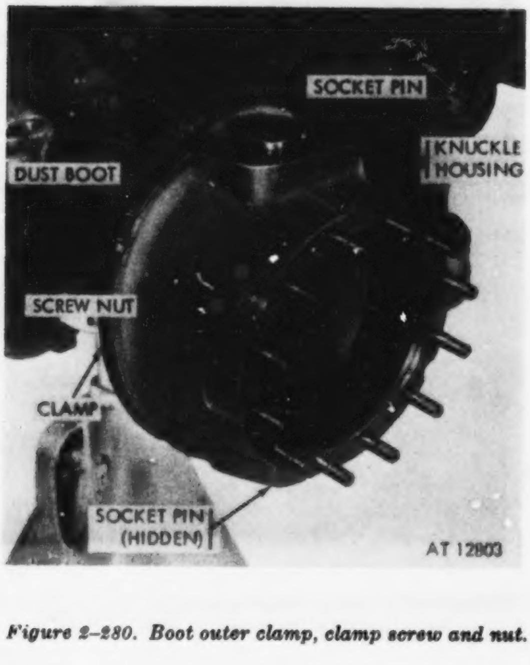


Figure 2-280. Boot outer clamp, clamp screw and nut.

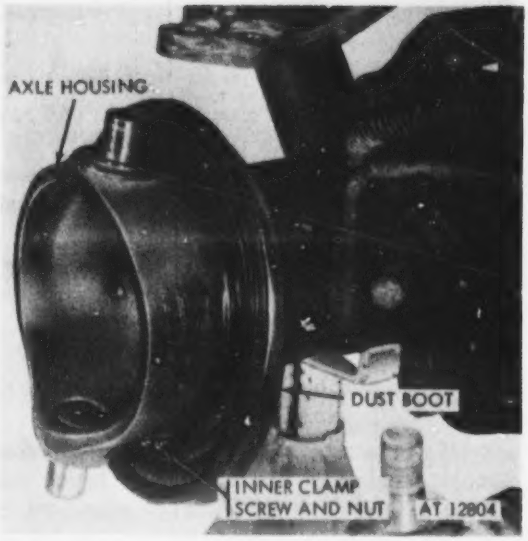


Figure 2-281. Boot and inner clamp, clamp screw and nut.

(2) Pack C-V joint with grease (GAA).

(3) Pack steering knuckle cavity with grease (GAA).

(4) Replace axle shaft oil seals (para 2-148*d*).

(5) Place new boot outer and inner boot clamps in position on axle housing, do not tighten clamp screw and nut.

Note. Position boot with "TOP" marking in upper position and install inner clamp at bottom with head of screw facing toward front of vehicle.

(6) Position steering knuckle in place on end of axle housing over pins.

(7) After inner dust boot clamp is firmly tightened, cut off protruding end of screw 3/16 inch from nut. File burs from end of screw.

(8) Place boot and outer boot clamp in position on steering knuckle.

Note. Install outer clamp screw with head facing towards front of vehicle.

(9) After outer dust boot clamp is firmly tightened, cut off protruding end of screw 3/16 inch from nut. File off burs from end of clamp screw.

(10) Install steering knuckle bushings (para 2-146*c*).

(11) Install axle shafts and C-V joint, sealed brake assembly, and wheel and tire assembly (para 2-145*c*).

2-148. Wheel Hub and Spindle

a. Description. The wheel hub assembly, consisting of the hub, wheel and drum mounting studs, triple lip seal, wheel bearings and face seal wipers, is mounted on the wheel spindle and held in place with a wheel bearing retaining ring. The wheel spindle is secured to the steering knuckle housing with 12 mounting nuts.

b. Removal.

(1) Remove wheel and tire assembly (refer to TM 9-2320-230-10).

(2) Remove six capscrews, retaining cap, with preformed packing, and step assembly (front axles only) (fig. 2-282). Discard preformed packing.

(3) Remove inspection plug and gasket. Retain gasket. Use suitable brake adjusting tool to back off brake adjusting bolts to facilitate removal of brakedrum assembly.

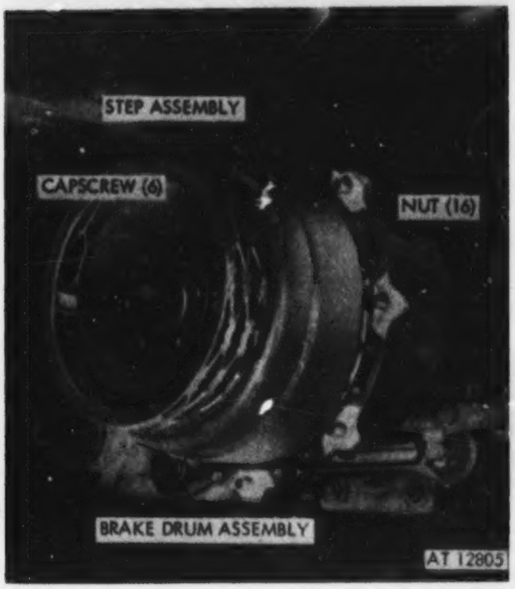


Figure 2-282. Removing or installing brakedrum and attaching hardware.

(4) Remove 16 mounting nuts and remove brakedrum assembly (fig. 2-282). Discard inner preformed packing.

(5) Disconnect air line from spindle to brake air chamber (fig. 2-283).

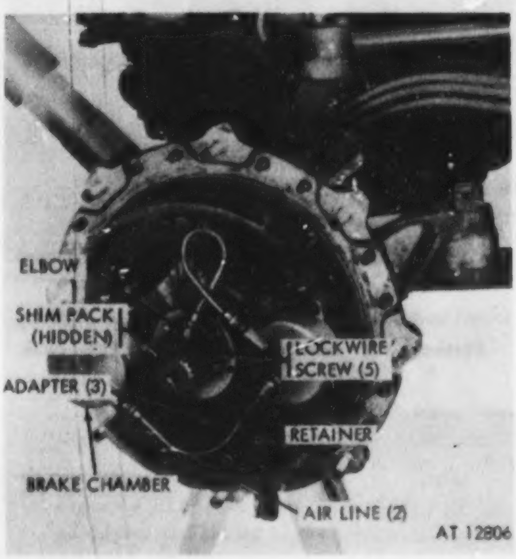


Figure 2-283. Removing or installing air lines, adapters, and sealed brake attaching hardware.

(6) Remove and discard lock wire (fig. 2-283).

(7) Remove five capscrews retaining shim pack and retainer (fig. 2-283).

(8) Remove retainer and shim pack (fig. 2-284). Retain shim pack for reassembly.

(9) Remove elbow fitting and straight adapter from spindle (fig. 2-284).

(10) Slide sealed brake with brakeshoes assembly (fig. 2-284) off wheel spindle.

(11) Remove outer wheel bearing face seal from sealed brake (fig. 2-285).

(12) Remove wheel bearing retaining ring from splines on wheel spindle (fig. 2-286).

(13) Slide hub assembly with outer wheel bearing (fig. 2-286) off wheel spindle. Remove outer wheel bearing from hub.

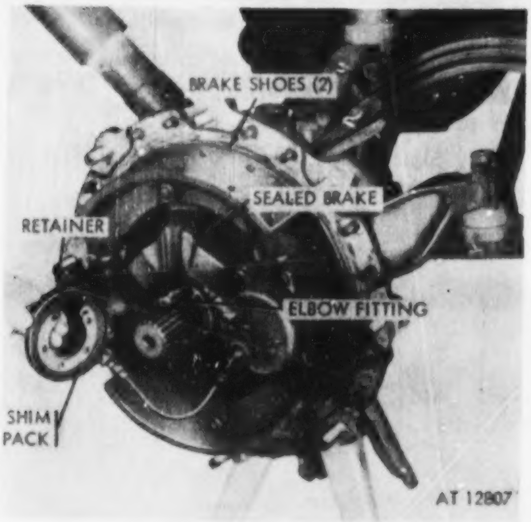

BRAKE SHOES (2)
SEALED BRAKE
RETAINER
ELBOW FITTING
SHIM PACK
AT 12807

Figure 2-284. Removing or installing shim pack and retainer.

(14) Remove and discard wheel hub triple lip seal (fig. 2-287).

(15) Mount bolt assembly (11613516) in a vise. Mount fixture assembly (11600323) on bolt assembly. Place wheel hub on fixture assembly. Install wheel bearing cup remover (11600917) on bolt assembly and install nut on bolt assembly (fig. 2-288).

(16) Tighten nut and press out bearing cup and face seal wiper (fig. 2-288).

(17) After bearing cup and face seal wiper are removed, turn hub assembly over and repeat operation to remove other bearing cup and face seal wiper.

(18) Remove inner wheel bearing (fig. 2-289).

(19) Disconnect air line and pressurization line from elbows located on upper periphery of wheel spindle flange (fig. 2-289).

(20) Remove 12 mounting nuts securing

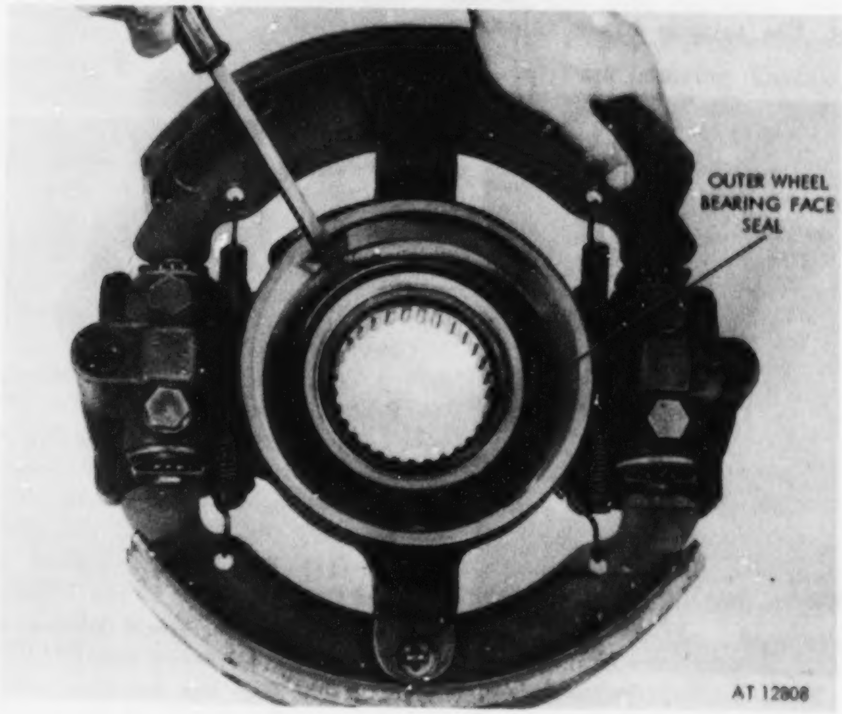

OUTER WHEEL BEARING FACE SEAL
AT 12808

Figure 2-285. Sealed brake assembly.

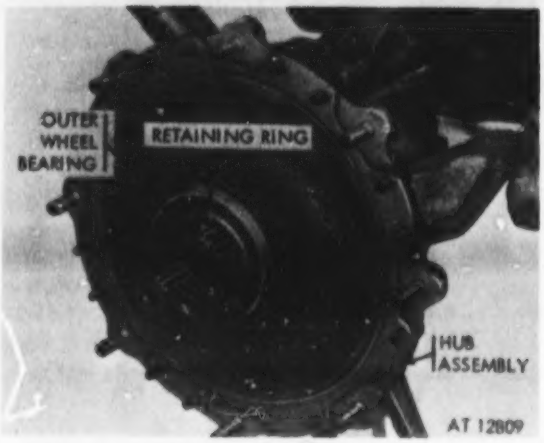

OUTER WHEEL BEARING
RETAINING RING
HUB ASSEMBLY
AT 12809

Figure 2-286 Removing or installing hub assembly.

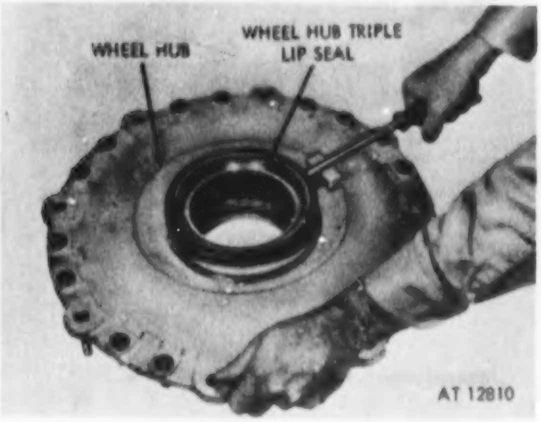

WHEEL HUB
WHEEL HUB TRIPLE LIP SEAL
AT 12810

Figure 2-287 Wheel hub triple lip seal.

wheel spindle assembly to steering knuckle housing (fig. 2-289).

(21) Remove seal wiper (fig. 2-289).

(22) Remove wheel bearing inner face seal (fig. 2-290).

(23) Remove grease fitting from spindle (fig. 2-290).

(24) Use soft-face hammer and tap wheel spindle assembly (fig. 2-290) to separate from steering knuckle housing. (Use knockout slots.)

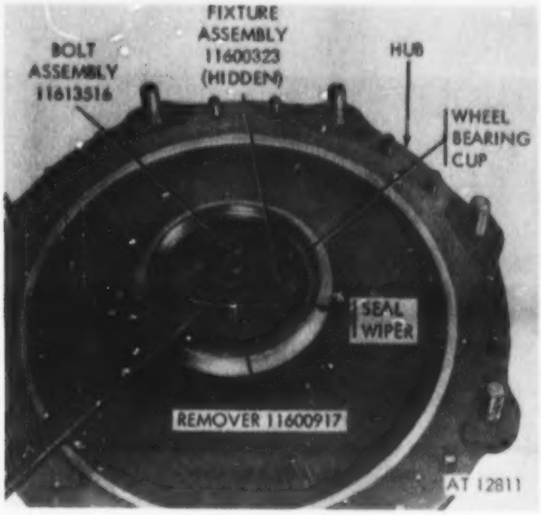

BOLT ASSEMBLY 11613516
FIXTURE ASSEMBLY 11600323 (HIDDEN)
HUB
WHEEL BEARING CUP
SEAL WIPER
REMOVER 11600917
AT 12811

Figure 2-288. Removing inner and outer wheel bearing cup and face seal wiper.

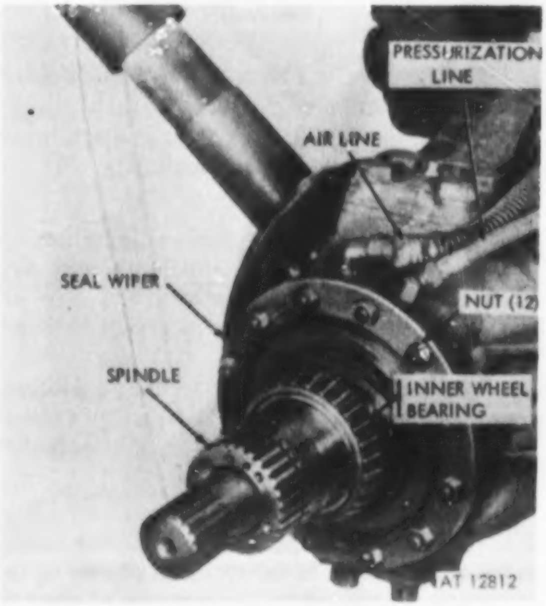

PRESSURIZATION LINE
AIR LINE
SEAL WIPER
NUT (12)
SPINDLE
INNER WHEEL BEARING
AT 12812

Figure 2-289. Inner wheel bearing and wheel spindle assembly.

(25) Remove axle shaft and CV joint assembly from axle housing.

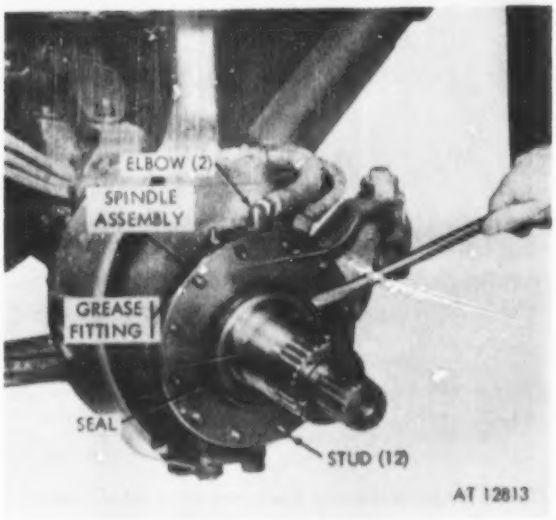


Figure 2-290. Air lines and wheel bearing inner face seal.

(26) Remove and discard drive shaft outer oil seal from spindle.

(27) Remove and discard axle shaft inner oil seal from axle housing assembly.

c. Cleaning.

(1) Clean all parts and housing cavity thoroughly in dry-cleaning solvent and dry with compressed air. All shafts and new oil seals must be coated with grease (GAA) prior to installation.

(2) Refer to TM 9-214 for inspection, care, and maintenance of bearings. Repack bearings with grease (GAA) prior to installation.

d. Installation.

(1) To insure satisfactory performance, extreme care must be taken in all phases of installation operations. Cleanliness is of the utmost importance.

(2) Always use new gaskets, seals, and preformed packings. Apply sealer to gaskets, metal-encased oil seals, end yoke and companion yoke splines, flange nuts, and any screw threads that enter through tapped holes.

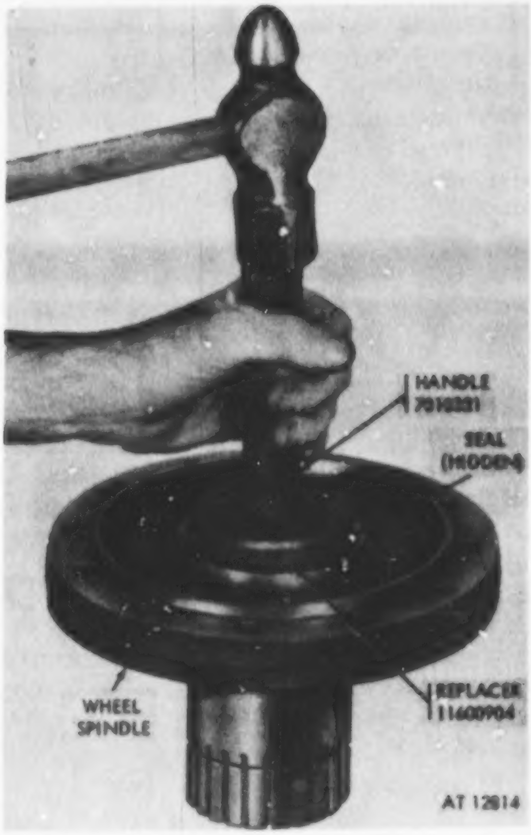


Figure 2-291. Axle shaft outer seal.

(3) Studs, bolts, nuts, screws, and other threaded items will be tightened to specified torques. Special torque specifications will be given in the assembly procedures.

***Caution:* Be sure all bolts, screws, and nuts are properly tightened, and all lock wires and cotter pins installed. A large portion of axle assembly failure has been traced to neglect of this precaution.**

(4) Use oil seal replacer (11600904) and handle (7010321) and install new axle shaft outer oil seal in flange end of wheel spindle (fig. 2-291).

(5) Use oil seal replacer (11600901) and handle (7010321) and install inner axle shaft oil seal in axle housing (fig. 2-292).

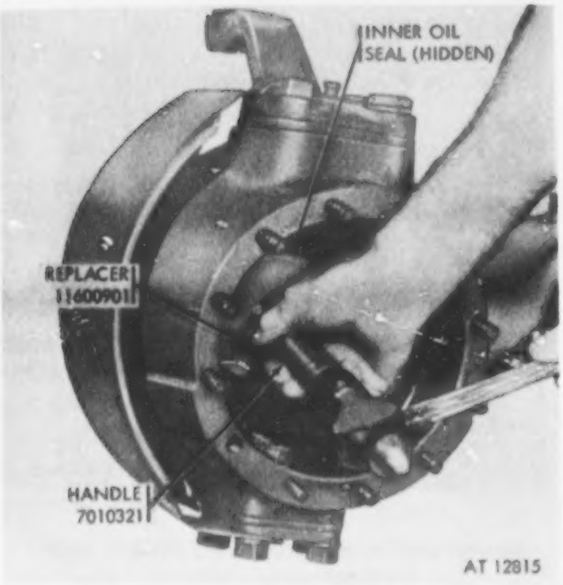

INNER OIL SEAL (HIDDEN)
REPLACER 11600901
HANDLE 7010321
AT 12815

Figure 2-292. Installing axle shaft outer oil seal.

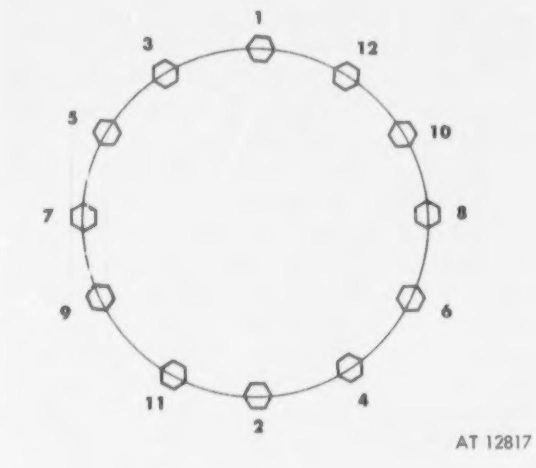

1
3
12
5
10
7
8
9
6
11
4
2
AT 12817

Figure 2-294. Wheel spindle nut tightening sequence.

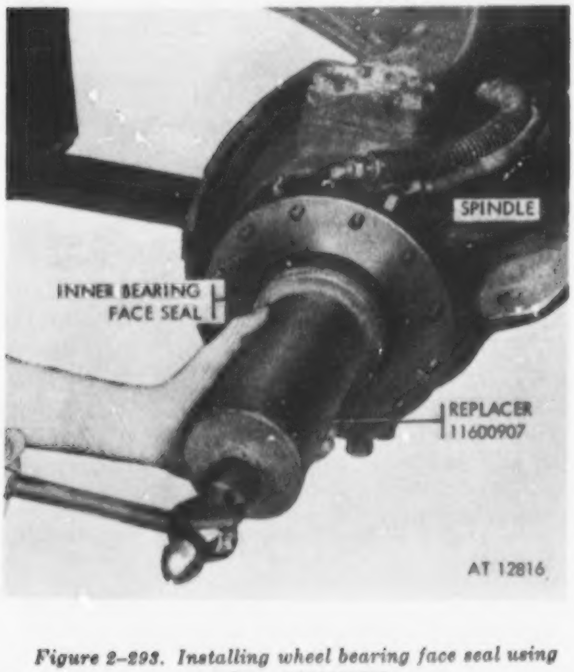

SPINDLE
INNER BEARING FACE SEAL
REPLACER 11600907
AT 12816

Figure 2-293. Installing wheel bearing face seal using replacer (11600907).

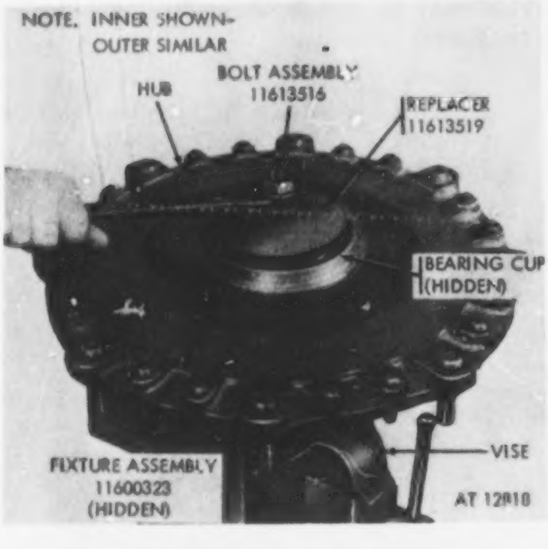

NOTE. INNER SHOWN-OUTER SIMILAR
HUB
BOLT ASSEMBLY 11613516
REPLACER 11613519
BEARING CUP (HIDDEN)
VISE
FIXTURE ASSEMBLY 11600323 (HIDDEN)
AT 12818

Figure 2-295. Installing wheel bearing cup using replacer (11613519).

(6) Install axle shaft and CV joint assembly in axle housing.

(7) Install wheel spindle on studs of steering knuckle housing (fig. 2-290).

Note. Wheel spindle assembly must be positioned with hole on flange (marked "TOP", "BRAKE") facing up.

(8) Install grease fitting in hole marked "grease" on wheel spindle (fig. 2-290).

(9) Connect air line and pressurization line to upper periphery of wheel spindle flange (fig. 2-289).

(10) Use seal replacer (11600907) and install wheel bearing inner face seal (fig. 2-298).

(11) Install seal wiper (fig. 2-289).

(12) Install 12 mounting nuts (fig. 2-289) and tighten to 33-45 lb-ft. Tighten nuts in sequence as shown in figure 2-294.

(13) Place bolt assembly (11613516) in a vise and place fixture assembly (11600323) on bolt assembly. Place hub on fixture assembly (fig. 2-295) with outer cup bore facing up.

(14) Lubricate outer wheel bearing cup with engine oil (OE) and use cup replacer (11613519) to install bearing cup (fig. 2-295).

(15) Lubricate face seal wiper with engine oil (OE) and use wiper replacer (11600905) to install outer face seal wiper (fig. 2-296).

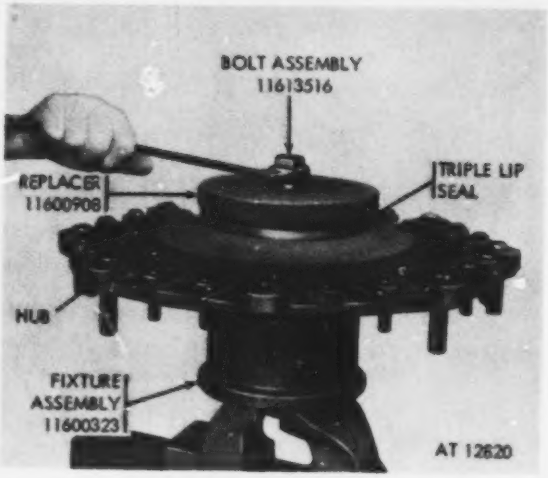

BOLT ASSEMBLY
11613516
REPLACER
11600908
TRIPLE LIP
SEAL
HUB
FIXTURE
ASSEMBLY
11600323
AT 12820

Figure 2-297. Installing wheel hub triple lip seal using replacer (11600908).

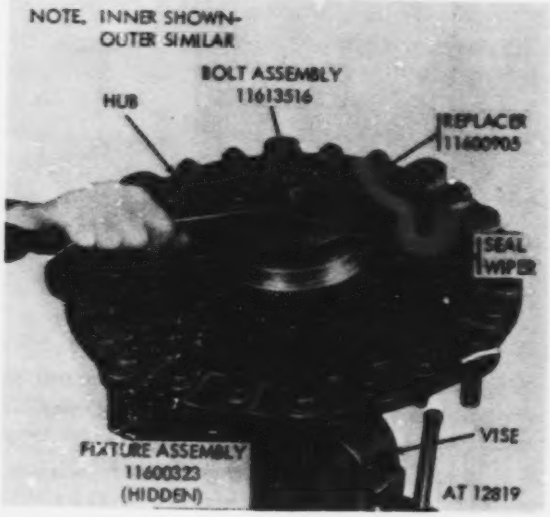

NOTE. INNER SHOWN-
OUTER SIMILAR
BOLT ASSEMBLY
11613516
HUB
REPLACER
11600905
SEAL
WIPER
VISE
FIXTURE ASSEMBLY
11600323
(HIDDEN)
AT 12819

Figure 2-296. Installing face seal wiper using replacer (11600905).

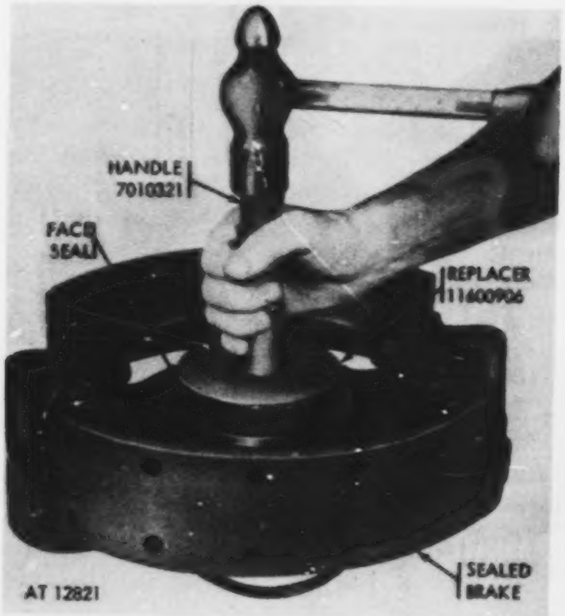

HANDLE
7010321
FACE
SEAL
REPLACER
11600906
SEALED
BRAKE
AT 12821

Figure 2-298. Installing face seal in sealed brake using replacer (11600906).

(16) After outer bearing cup and face seal wiper are installed, turn hub assembly over with inner cup bore facing up. Repeat operations (14) and (15) above for inner wheel bearing cup and seal wiper.

(17) Lubricate wheel hub triple lip seal with engine oil (OE) and use replacer (11600908) to install triple lip seal (fig. 2-297).

(18) Remove hub assembly from holding fixture.

(19) Install inner wheel bearing cone on wheel spindle with large diameter of cone toward wheel spindle flange (fig. 2-289).

(20) Slide hub assembly on wheel spindle until inner bearing cone rollers are seated in inner bearing cup.

(21) Install outer wheel bearing cone with small diameter of cone toward hub (fig. 2-286).

(22) Install wheel bearing retaining ring (fig. 2-286) and coat outer edge of retaining ring with sealer (MIL-S-45180, type II).

(23) Use seal replacer (11600906) and handle (7010321) to install new outer wheel bearing face seal in sealed brake (fig. 2-298).

(24) Slide sealed brake with brakeshoes on splines of wheel spindle (fig. 2-284).

(25) Apply sealer (MIL-S-45180, type II) to straight adapter and elbow threads and connect adapter to spindle and elbow to adapter (fig. 2-299). Do not tighten elbow.

(26) Position wheel bearing preload gage (11600534) on wheel spindle face. Loosen adjusting nut of gage until gage seats firmly on spindle face. Secure preload gage to wheel spindle with three existing capscrews. Tighten capscrews firmly, making sure adjusting nut is free (fig. 2-299).

(27) Install socket wrench (11600537) on adjusting nut of preload gage. Use torque wrench to tighten adjusting nut to 90 lb-ft (fig. 2-300).

Note. Rotate wheel hub while tightening adjusting nut to prevent obtaining a false reading on torque wrench dial indicator.

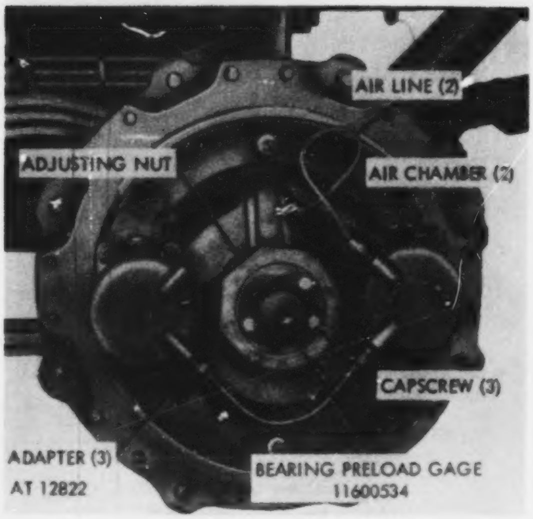


Figure 2-299. Bearing preload gage (11600534) installed on wheel spindle.

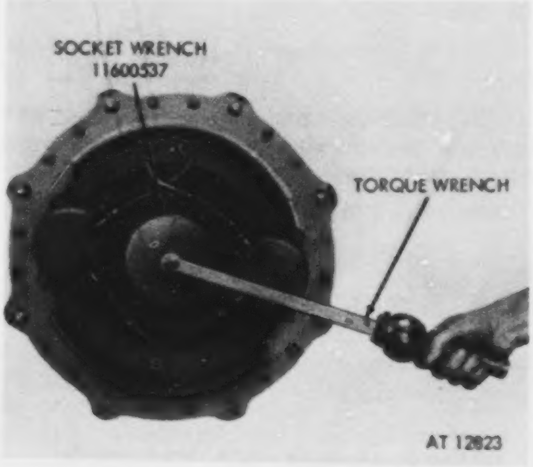


Figure 2-300. Using bearing preload gage.

(28) Remove socket wrench and observe reading on adjusting nut (opposite "TOP" marking line). This reading indicates the necessary shim pack thickness required to obtain the desired wheel bearing preload of 5-25 lb-in.

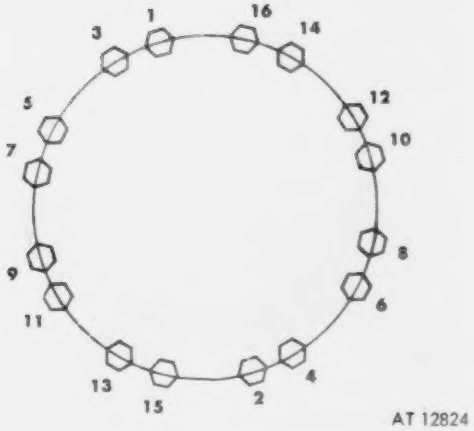


Figure 2-301. Brakedown nut tightening sequence.

(29) Loosen adjusting nut, and remove capscrews securing preload gage to wheel spindle. Remove bearing preload gage.

(30) Tighten elbow fitting on wheel spindle (fig. 2-284).

(31) Position shim pack on wheel spindle face and install retainer with five capscrews (fig. 2-283). Tighten capscrews to 19-25 lb-ft.

(32) Install lock wire taking care that wire does not pass between axle shaft and capscrews (fig. 2-283).

(33) Apply sealer (MIL-S-45180, type II) to threads and connect air line to elbow (fig. 2-283). Tighten air line to 7-9 lb-ft.

(34) Apply sealer (MIL-S-45180, type II) in machined groove in brakedrum flange, and install new inner preformed packing seal in machined groove.

(35) Place brakedrum assembly on studs of wheel hub and install 16 mounting nuts (fig. 2-282). Tighten nuts to 33-45 lb-ft in sequence as shown in figure 2-301.

(36) Install new outer preformed packing.

(37) Position retaining cap (or step assembly) and install six capscrews (fig. 2-282). Tighten capscrews to 33-45 lb-ft.

(38) Use suitable brake adjusting tool to tighten front upper and lower rear brake adjusting bolts while rotating wheel hub in forward direction. Tighten bolts until there is a heavy drag indicating complete brakeshoe contact with drum.

(39) Back off adjusting bolts until brakeshoes are free and do not touch brake drum as wheel hub is rotated.

(40) Install gasket and inspection plug. Tighten inspection plug firmly.

(41) Install wheel and tire assembly (refer to TM 9-2320-230-10).

Section XXVI. REAR AXLE

2-149. Scope

a. General. This section contains service procedures and removal and installation instructions for the following rear axle components: differential thru shaft input and output yokes and seals, axle shafts and sealed brake assembly.

b. Description. Two rear drive axles make up the rear tandem drive. The axle assemblies are identical, and removal and installation procedures for components and parts are the same for both axles.

2-150. Service

Refer to LO 9-2320-230-12 for service instructions.

2-151. Differential Thru Shaft Input and Output Yoke and Seals

For removal and installation of the differential thru shaft input and output yokes and seals, refer to paragraphs 2-143.

Note. The front axle yoke and seal assemblies are identical to the rear axle yoke and seal assemblies.

2-152. Axle Shaft

a. Description. The one-piece full floating axle shafts of the tandem rear axles may be removed without taking off the tires or wheel end assemblies.

b. Removal.

(1) Raise vehicle to remove weight from wheel assembly. Remove six capscrews securing retaining plate to brakedrum (fig. 2-302). Remove retaining plate and preformed packing.

(2) Remove lockring from end of axle shaft (fig. 2-303).

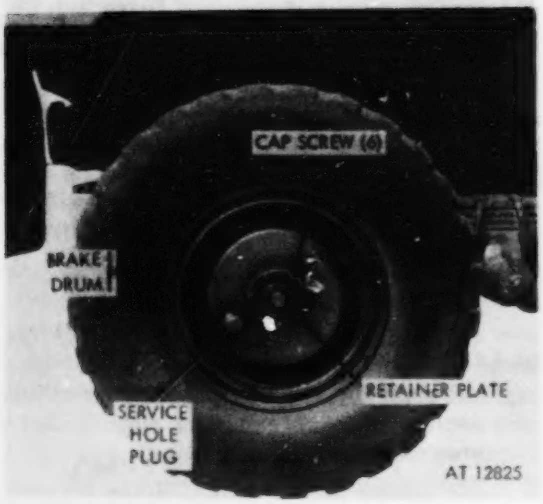

CAP SCREW (6)
BRAKE DRUM
RETAINER PLATE
SERVICE HOLE PLUG
AT 12825

Figure 2-302. Axle shaft retaining plate.

(3) Remove 16 nuts securing brakedrum to wheel hub assembly. Remove brakedrum and preformed packing.

(4) Remove axle shaft by pulling shaft straight outward, using care not to damage axle shaft seal (fig. 2-304).

c. Installation.

Note. If new axle shaft is installed, new axle shaft oil seals must be installed. Refer to paragraph 148*d*.

(1) Before inserting axle shaft into axle housing, lightly coat end of shaft with grease or oil to aid in installation.

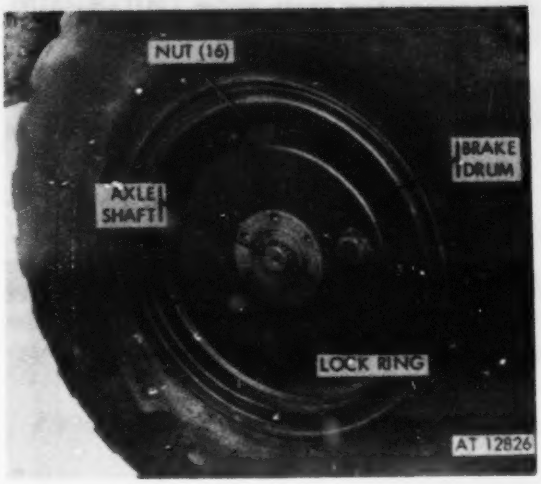

NUT (16)
BRAKE DRUM
AXLE SHAFT
LOCK RING
AT 12826

Figure 2-303. Rear axle shaft lockring and brakedrum.

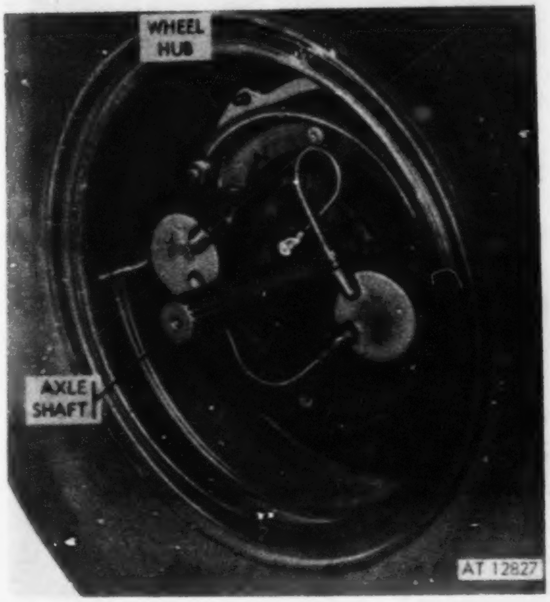

WHEEL HUB
AXLE SHAFT
AT 12827

Figure 2-304. Rear axle shaft.

(2) Carefully insert axle shaft through spindle and into axle housing.

Note. Rotate axle shaft slowly to aid engagement of axle shaft splines with differential side gear splines.

(3) Install preformed packing in brakedrum groove and apply sealer (MIL-S-45180, type II) on packing.

(4) Position brakedrum, with preformed packing, on wheel hub and secure with 16 nuts. Tighten nuts to 33-45 lb-ft in sequence as shown in figure 2-301.

(5) Install lockring on axle shaft (fig. 2-303).

(6) Position retainer plate on brakedrum using new preformed packing and sealer (MIL-S-45180, type II. Secure plate to drum with six capscrews (fig. 2-302). Tighten capscrews to 59-75 lb-ft.

2-153. Rear Axle Wheel Spindle

a. Description. The rear axle wheel spindle is mounted to the axle housing and supports the weight of vehicle.

b. Removal.

(1) Remove wheel and tire assembly TM 9-2320-230-10).

(2) Remove brakedrum and axle shaft (para 2-152*b*).

(3) Remove sealed brake assembly (para 2-145*b*).

Note. When sealed brake or wheel bearings are replaced, wheel bearing preload must be preformed and proper thickness of shim pack determined. Refer to paragraph 2-148.

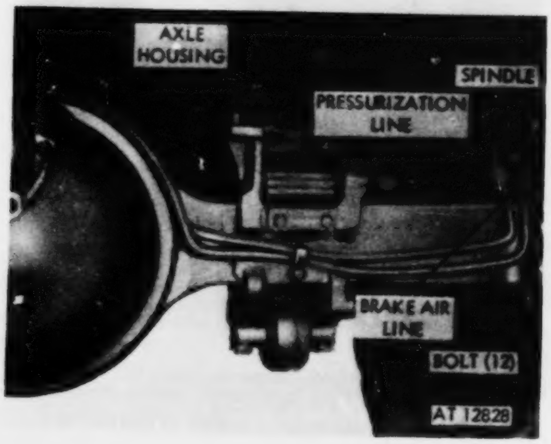


Figure 2-305. Rear wheel spindle mounting bolts and air lines.

(4) Remove wheel hub assembly (para 2-148*b*).

(5) Disconnect airbrake and pressurization lines from spindle (fig. 2-305).

(6) Remove 12 bolts and nuts securing wheel spindle and triple lip seal wiper to axle housing.

(7) Remove triple lip seal wiper and spindle (para 2-148).

c. Installation.

(1) Clean all parts thoroughly to remove grease and foreign material. Repack wheel bearings or replace if required (para 2-148).

(2) Install new axle shaft oil seals (para 2-148).

(3) Position spindle and hub seal wiper on axle housing and install 12 nuts and bolts securing spindle to axle housing (fig. 2-305). Tighten nuts in sequence, as shown in figure 2-294, to 33-45 lb-ft.

(4) Connect the airbrake line and the pressurization line to spindle (fig. 2-305).

(5) Install wheel bearing cups and face seals (para 2-148). Install inner wheel bearing, hub assembly and outer bearing on spindle and secure with hub retaining ring. Refer to paragraph 2-148.

(6) Install sealed brake. Refer to paragraph 2-148.

(7) Determine preload of wheel bearing. Refer to paragraph 2-148.

(8) Position proper shims (shim pack) and retainer on spindle end and secure with five capscrews. Refer to paragraph 2-148.

(9) Install axle shaft in axle housing. Refer to paragraph 2-152*c*.

Note. Slowly rotate axle shaft while inserting in axle housing to assist in alinement of axle splines with differential drive gear.

(10) Install brakedrum and preformed packing. Refer to paragraph 2-148*c*. Install lockring.

(11) Install retainer plate on brakedrum. Refer to paragraph 2-148*c*.

Section XXVII. BRAKES

2-154. General

This section contains procedures and instructions for the removal, installation and adjustment of the service brake and handbrake components.

2-155. Description

a. Service Brake System. The service brake system of the truck is a full air type, controlled by a foot pedal and brake treadle valve mounted to the floor of the cab. Pressurized air from the air reservoirs operates the air chambers located in each wheel brake assembly. The chambers when actuated apply pressure to both toe and heel of the self centering brakeshoes. Shoe retainers, springs and rods secure the shoes to the brake spider which fits on the splines of the wheel spindle. Each air chamber has two self adjusting screws. The adjusting screws are accessible through a hole opening in the brakedrum.

b. Handbrake. The handbrake consists of a brakedrum and brakeshoes mounted on a backing plate and secured to the transfer case rear output shaft bearing retainer. The handbrake is cable-actuated by the brake actuating lever located to the right of the driver's seat. The brakedrum is bolted to the transfer rear output shaft flange and applies braking to rear output drive shaft.

2-156. Service Brakeshoe Replacement

a. Removal.

(1) Place jack under axle and raise until tire is free of floor.

(2) Remove brakedrum from wheel hub (para 2-152*b*).

(3) Hold anti-rattle rod retainer and push rod inward and twist one quarter turn to release retainer from rod. Remove rod, spring and two spring retainers from each brakeshoe (fig. 2-306).

(4) Remove two brakeshoe return springs (fig. 2-307).

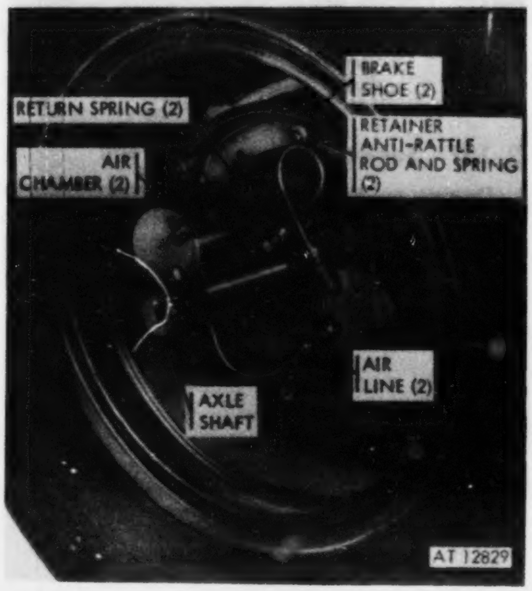


Figure 2-306. Wheel service brake assembly, rear wheel.

(5) Remove brakeshoes.

b. Installation.

(1) Clean all dust and dirt from sealed brake assembly, wheel spindle end and axle shaft.

(2) Lightly lubricate chamber adjusting screws with general purpose lubricating oil (PL). making sure screws turn freely.

(3) Turn screws into adjusting sleeves until they bottom, then backoff screw 1/4 turn.

(4) Place brakeshoes on sealed brake assembly and secure each shoe with anti-rattle rod, spring, and two spring retainers (fig. 2-306).

(5) Install two brakeshoe return springs (fig. 2-307).

(6) Center shoes on sealed brake and make sure brakeshoe ends are properly seated in adjusting screw grooves.

(7) Use lint-free cloth to wipe brakedrum clean. Inspect brakedrum face for cracks, deep scores and signs of being out-of-round. If necessary, replace drum.

Note. Allow no grease or oil on brakeshoe linings or face of brakedrum.

(8) Install brakedrum (para 2-152*c*).

2-157. Service Brake Adjustment

During normal operation, the brakeshoes and linings automatically adjust themselves. However, when brakedrums, shoes, linings, or sealed brake are replaced, an initial manual brake adjustment is required. To make this adjustment proceed as follows:

a. Place jack under axle and raise until tires is free of floor.

b. Remove service hold plug (fig. 2-302) and gasket from brakedrum.

c. Turn wheel until servicehole is alined with rear upper and front lower adjusting star screw (fig. 2-308).

d. Use a screwdriver or suitable brake adjusting tool and turn adjusting screw until brakedrum binds (fig. 2-308).

e. Back-off adjusting star wheel until brakedrum is free of drag (fig. 2-308).

f. Install service hole plug and gasket.

g. Remove jack from under axle.

2-158. Handbrake Drum Replacement

Warning: **Before disconnecting propeller shaft and removing handbrake drum, place chocks under truck wheels.**

a. Removal.

(1) Disconnect rear axle drive propeller shaft from transfer flange yoke (para 2-139).

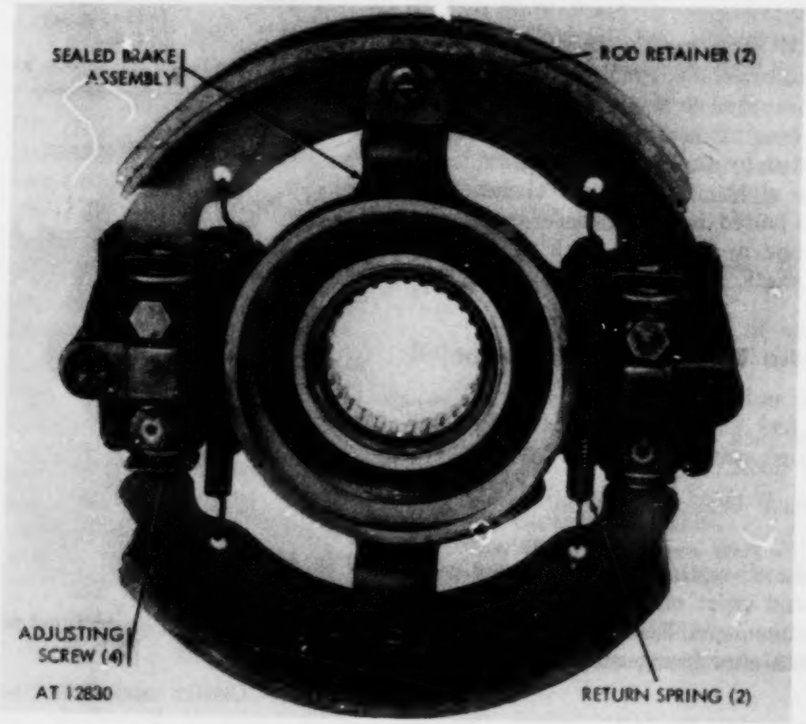


Figure 2-307. Rear side of sealed brake with brakeshoes and return springs, installed.

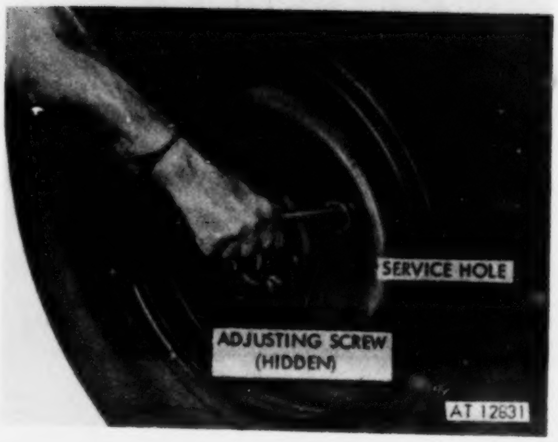

SERVICE HOLE
ADJUSTING SCREW (HIDDEN)
AT 12831

Figure 2-308. Adjusting service brake.

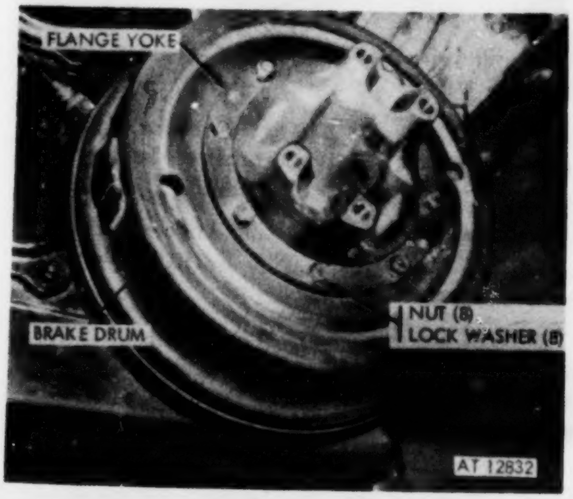

FLANGE YOKE
BRAKE DRUM
NUT (8)
LOCK WASHER (8)
AT 12832

Figure 2-309. Handbrake drum and propeller shaft flange.

(2) Remove eight nuts and lockwashers securing brakedrum and flange yoke to drive flange (fig. 2-309).

(3) Using two puller screws (3/8 x 24 x 2 1/2 in.) in tapped holes provided in flange yoke remove yoke from drum (fig. 2-310). Remove brakedrum.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Adjust handbrake (para 2-160).

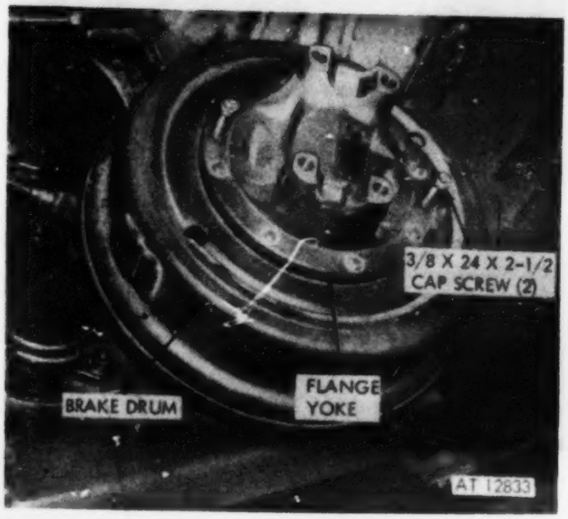

3/8 X 24 X 2-1/2 CAP SCREW (2)
BRAKE DRUM
FLANGE YOKE
AT 12833

Figure 2-310. Using puller screws to remove flange yoke.

2-159. Handbrake Shoe Replacement

a. Removal.

(1) Remove handbrake brakedrum (para 2-158).

(2) Remove two brakeshoe return springs and anchor pin brace (fig. 2-311).

(3) Spread brakeshoes at top side and remove shoe assembly from anchor pins and backing plate.

(4) Remove adjusting screw spring, and adjusting screw assembly (fig. 2-311).

b. Installation.

(1) Clean all dust and dirt from backing plate and drive flange (fig. 2-312).

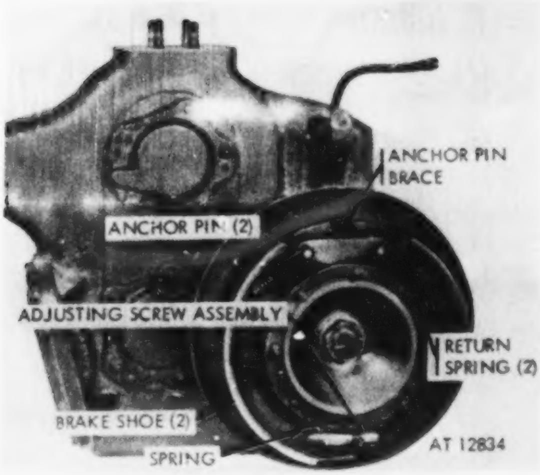


Figure 2-311. Handbrake shoes and return springs.

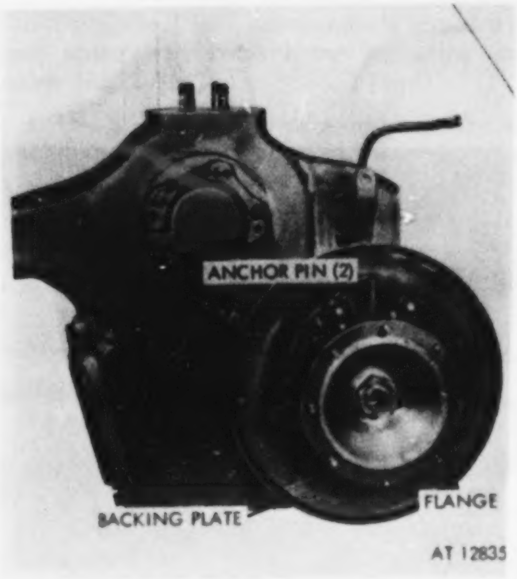


Figure 2-312. Handbrake backing plate and transfer drive flange.

(2) Lightly lubricate adjusting screw and threads and screw end socket (fig. 2-313) with general purpose lubricating oil (PL). Turn adjusting screw into end nut until it bottoms and backoff one turn.

(3) Place adjusting screw assembly in adjusting ends of brakeshoe webs.

(4) Install adjusting screw spring by hooking one end into brakeshoe web hole nearest adjusting screw star washer wheel. Hook opposite end of spring into the opposite brake shoe web hole.

(5) Spread anchor end of brakeshoes and position brakeshoes on backing plate and anchor pins (fig. 2-311).

(6) Install anchor pin brace and two brake-shoe return springs (fig. 2-311).

(7) Install brakedrum (para 2-158).

Note. Handbrake must be adjusted before installing propeller shaft to transfer flange yoke. Refer to paragraph 2-160 for adjustment of handbrake.

2-160. Adjustment of Handbrake Shoes

Whenever the brake backing plate, brakeshoes or brakedrum are replaced or handbrake cannot be adjusted at operating lever in cab, the handbrake shoes must be adjusted. To make this adjustment proceed as follows:

a. Place chocks under truck wheels and disconnect rear axle drive propeller shaft from brakedrum flange yoke (para 2-139).

b. Loosen knurled adjusting knob on end of handbrake lever in cab (fig. 2-314) to loosen cable adjustment linkage.

c. Start engine if necessary for normal air pressure. Place transfer selector in neutral position; rotate brakedrum and aline access hole with brake adjusting screw star wheel.

d. Adjust brakeshoes by turning star wheel (fig. 2-313) with screw driver or suitable brake adjusting tool inserted through access hole. Turn star washer until a drag is felt when turning brakedrum. Back-off star washer until drum can be turned free of drag. Operate parking brake lever and adjust linkage as required (para 2-162).

e. Install propeller shaft to brakedrum flange (para 2-139) and remove chocks from wheels.

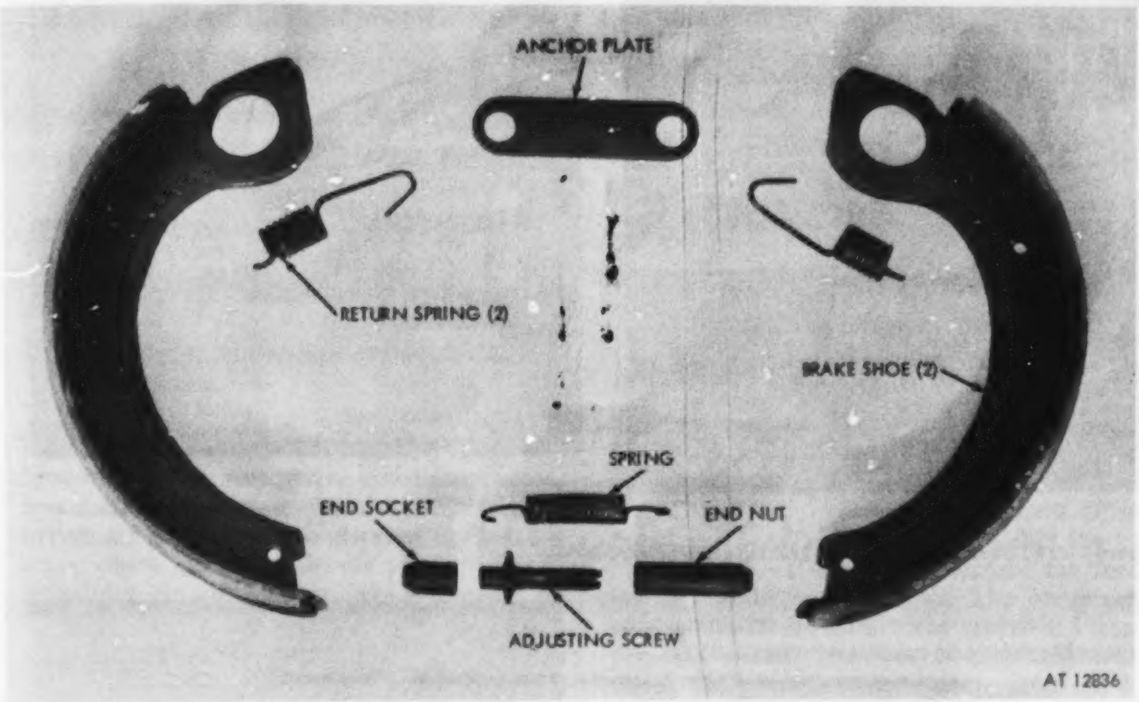

ANCHOR PLATE
RETURN SPRING (2)
BRAKE SHOE (2)
SPRING
END SOCKET
END NUT
ADJUSTING SCREW
AT 12836

Figure 2-313. Adjusting screw assembly and brakeshoes, exploded view.

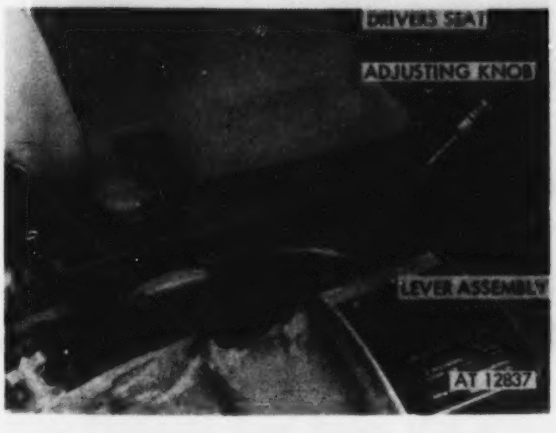

DRIVERS SEAT
ADJUSTING KNOB
LEVER ASSEMBLY
AT 12837

Figure 2-314. Handbrake lever assembly.

2-161. Handbrake Lever and Cable Replacement

Warning: **Before removing handbrake lever or cable, place chocks under truck wheels.**

a. Removal.

(1) Remove cotter pin, flat washer, and clevis pin and disconnect brake cable clevis from brake operating lever (fig. 2-315).

(2) Remove two bolts, nuts and lockwashers securing handbrake cable clamp to support bracket mounted on transfer case (fig. 2-315).

(3) Remove two capscrews and lockwashers securing cable seal and plate to floor of cab (fig. 2-316).

(4) Remove spring clip securing cable housing to lever assembly (fig. 2-316).

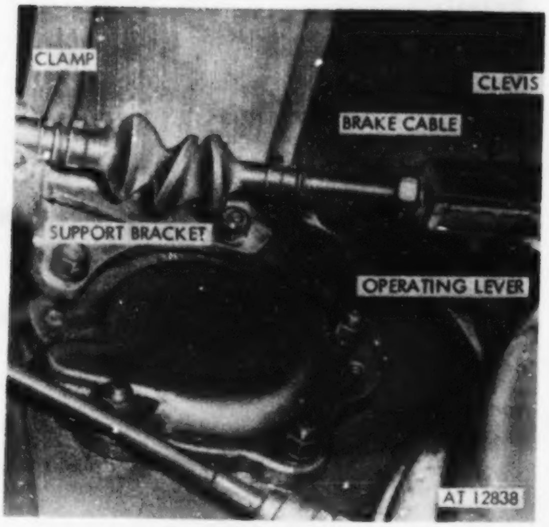

CLAMP
CLEVIS
BRAKE CABLE
SUPPORT BRACKET
OPERATING LEVER
AT 12838

Figure 2-315. Handbrake cable and backing plate lever.

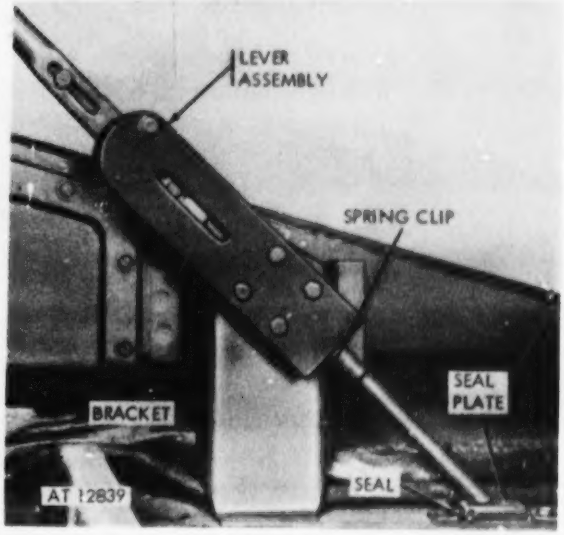

LEVER ASSEMBLY
SPRING CLIP
SEAL PLATE
BRACKET
SEAL
AT 12839

Figure 2-316. Handbrake lever assembly bracket and cable seal and plate.

(5) Remove cotter pin and retaining pin from cable yoke and hand lever (fig. 2-317).

(6) Remove four bolts, flat washers, lockwashers and nuts securing brake lever assembly to mounting bracket (fig. 2-316). Remove lever assembly from bracket.

(7) Remove cable adjusting nut (fig. 2-317), then carefully pull cable and cable housing from lever assembly and through hole in cab floor and remove.

b. Installation.

(1) Refer to removal procedures and reverse sequence.

(2) Refer to paragraph 2-162 and adjust handbrake lever and cable.

2-162. Handbrake Lever and Cable Adjustment

a. Place handbrake lever in off (down) position (fig. 2-314).

b. Turn knurled knob of handbrake lever out to relieve cable tension.

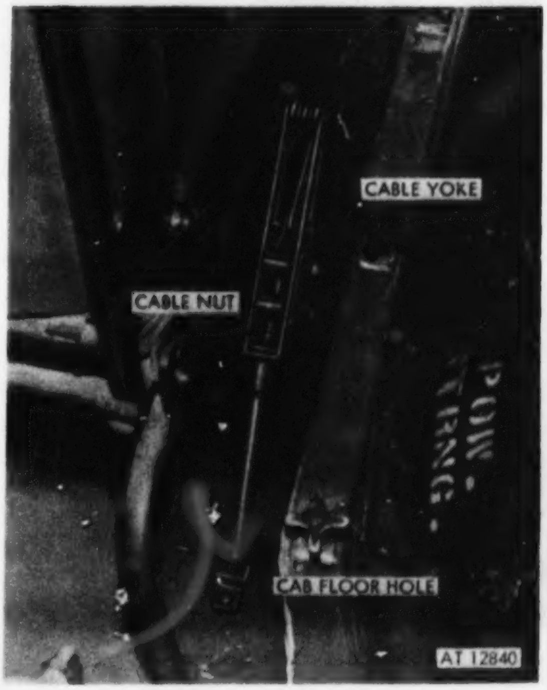

CABLE YOKE
CABLE NUT
CAB FLOOR HOLE
AT 12840

Figure 2-317. Handbrake lever assembly.

c. Remove cotter pin and clevis pin securing cable clevis to brake operating lever (fig. 2-315).

d. Aline clevis hole with brake arm by loosening locknut and rotating clevis.

e. Install clevis pin and cotter pin to secure to operating lever. Tighten clevis locknut (fig. 2-315).

f. Adjust knurled knob on brake hand lever (fig. 2-314), until desired of cable tension is obtained.

Section XXVIII. AIR PRESSURE SYSTEM

2-163. General

This section contains replacement instructions for the vehicle air pressurization and brake system components.

2-164. Description

The vehicle air system consists of an air compressor, air reservoirs, governor, valves, manifolds, air lines, and fittings. The engine driven air compressor is controlled by the governor which maintains the air pressure in the reservoirs. An air pressure gage is mounted on the instrument panel and connected to the air system to indicate the air pressure in the system. Whenever the pressure in the system is below a safe operating pressure, the low-air pressure switch actuates the low-air pressure indicator (buzzer). The vehicle air system can be divided into five functional sub-systems; service brakes, windshield wipers, transfer control, component pressurization, and door seal pressurization (M656 only).

a. Service Brakes System (Figs. 2-318 through 2-321). The service brakes are controlled by a foot operated treadle valve on the floor of the cab. The XM757 vehicle also incorporates a hand control trailer brake valve mounted on the steering column. If an air line occurs beyond the tractor-trailer protection valve, the air loss can be stopped by moving the tractor-trailer protection control valve to the emergency position. The nominal operating air pressure range of the air system is 105-125 psi.

b. Windshield Wiper System (Fig. 2-322). The windshield wiper motors are controlled by a hand operated valve mounted on the instrument panel. The normal range of air pressure in the windshield wiper system is 105-125 psi.

c. Transfer Control System (Fig. 2-323). The transfer control which is mounted on the instrument panel, allows shift selection of rear axle, all axles, and neutral. The normal operating air pressure range is 105-125 psi.

d. Component Pressurization System (Figs. 2-324 and 2-325). The cavities within the vehicle components can be pressurized for fording or swimming operations. The component pressurization is controlled by means of a hand operated valve, mounted on the instrument panel. The operating air pressure range of the system is 3-5 psi.

e. Door Seals Pressurization System—M656 (Fig. 2-326). The door, tailgate and side gates seals of the M656 vehicle can be pressurized for swimming operations to prevent leakage. The seal pressurization is controlled by the same valve used for component pressurization. The normal operating air pressure of this system is 30 psi.

2-165. Air Lines, Hoses and Fittings

a. Removal.

(1) Release air pressure in air system by alternately opening the drain cocks of the three air reservoirs.

(2) Remove tube or hose to be replaced.

b. Inspection and Replacement.

(1) Inspect for hoses or tubes which are cracked, dented or bent, or restrict air flow.

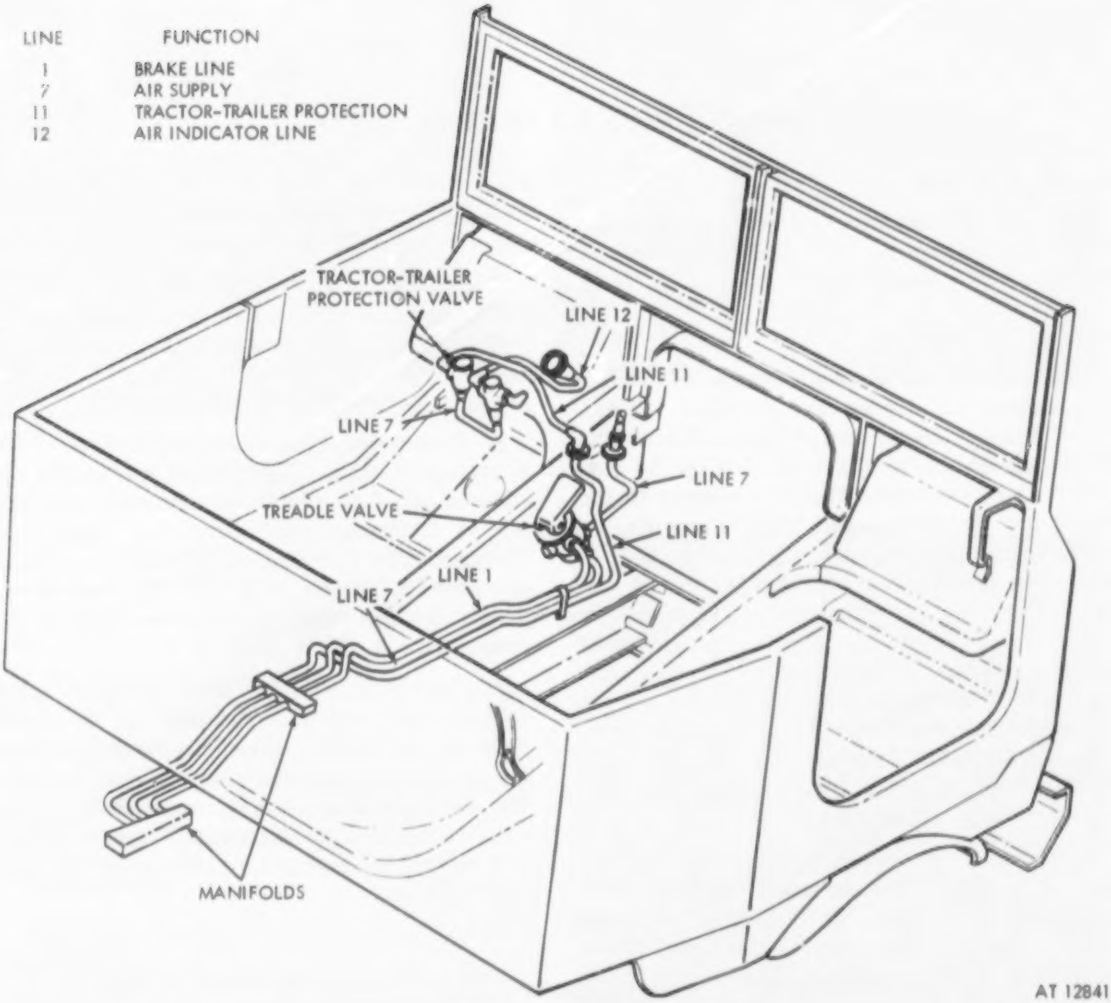

LINE FUNCTION
1 BRAKE LINE
7 AIR SUPPLY
11 TRACTOR-TRAILER PROTECTION
12 AIR INDICATOR LINE
TRACTOR-TRAILER PROTECTION VALVE
LINE 12
LINE 11
LINE 7
LINE 7
TREADLE VALVE
LINE 11
LINE 1
LINE 7
MANIFOLDS
AT 12841

Figure 2-318. Service brake system—cab (M656 and XM791).

(2) Replace only those hoses or tubes which are damaged.

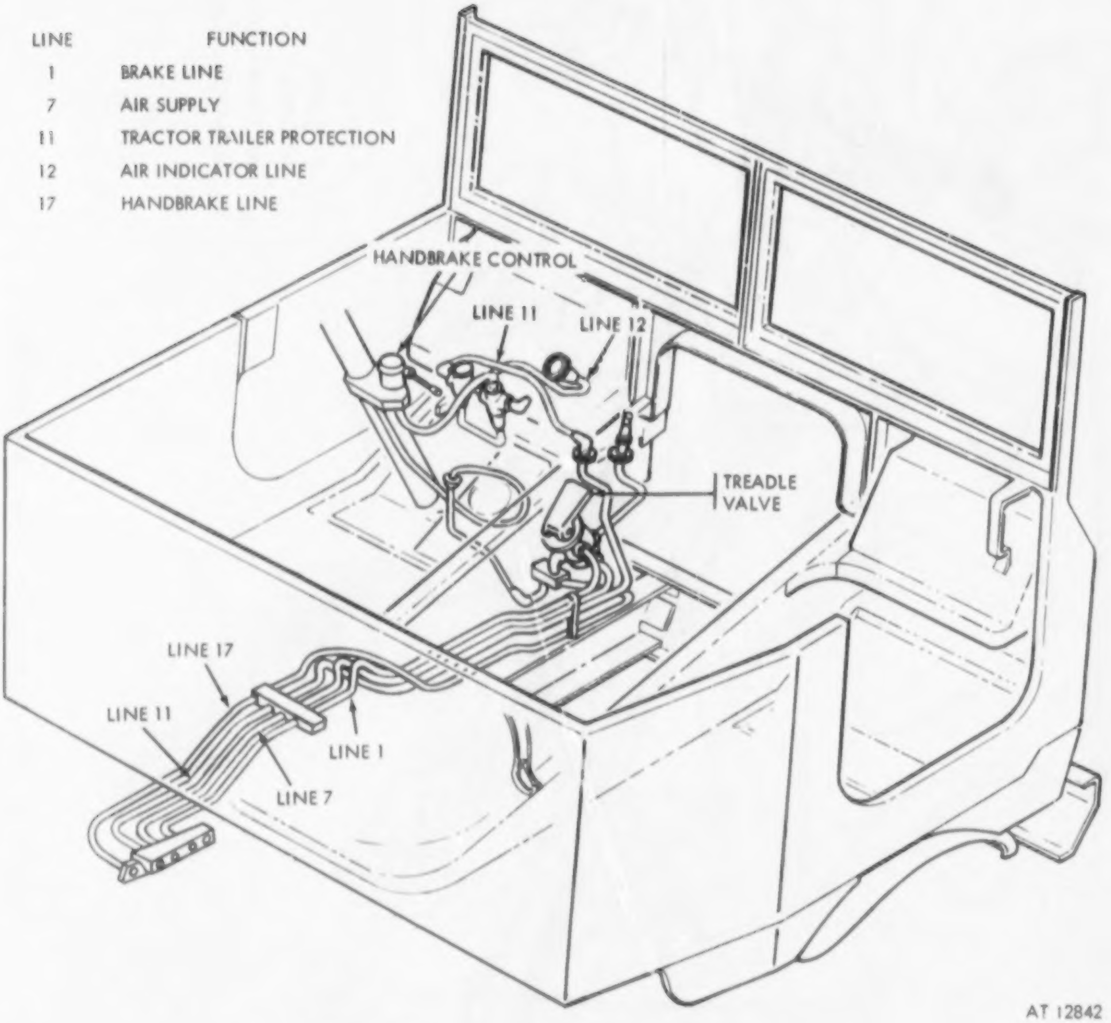
c. Installation.

(1) Cut tubing and conduit to desired length.

(2) Stamp bands with proper line number.

(3) Apply sealing compound (MIL-S-45180, type II) to pipe threads of all fittings.

(4) Build air pressure and apply soap so-



LINE	FUNCTION
1	BRAKE LINE
7	AIR SUPPLY
11	TRACTOR TRAILER PROTECTION
12	AIR INDICATOR LINE
17	HANDBRAKE LINE

HANDBRAKE CONTROL
LINE 11
LINE 12
TREADLE VALVE
LINE 17
LINE 11
LINE 1
LINE 7
AT 12842

Figure 2–319. Service brake system—cab (XM757).

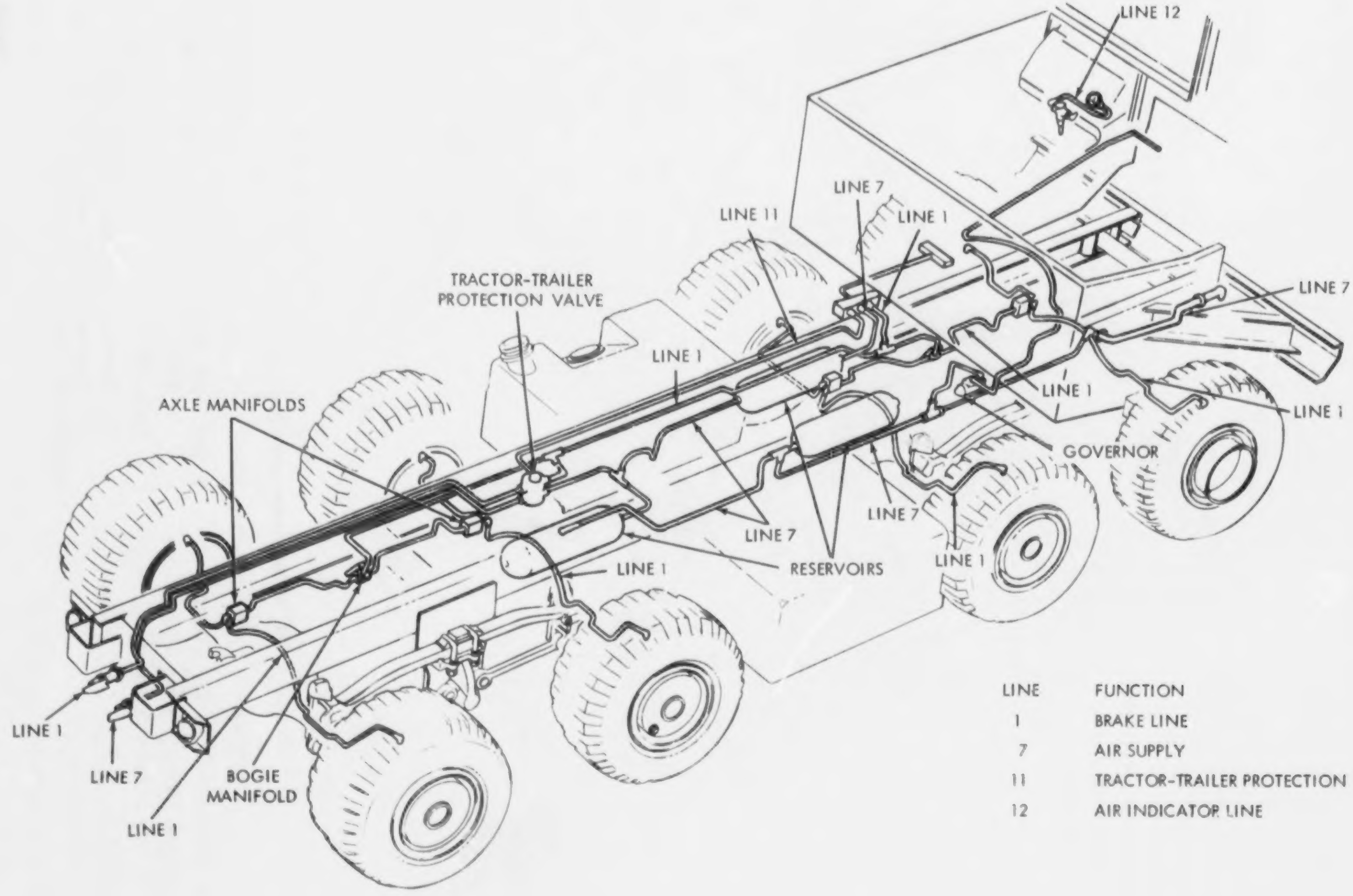
lution with a paint brush to the fittings and tubes just installed. Observe lines and fittings for evidence of soap bubbles. Correct any leaks which are evident.

2–166. Air Reservoir Safety Valve (Fig. 2–327)

a. Removal.

(1) Release air pressure in air system.

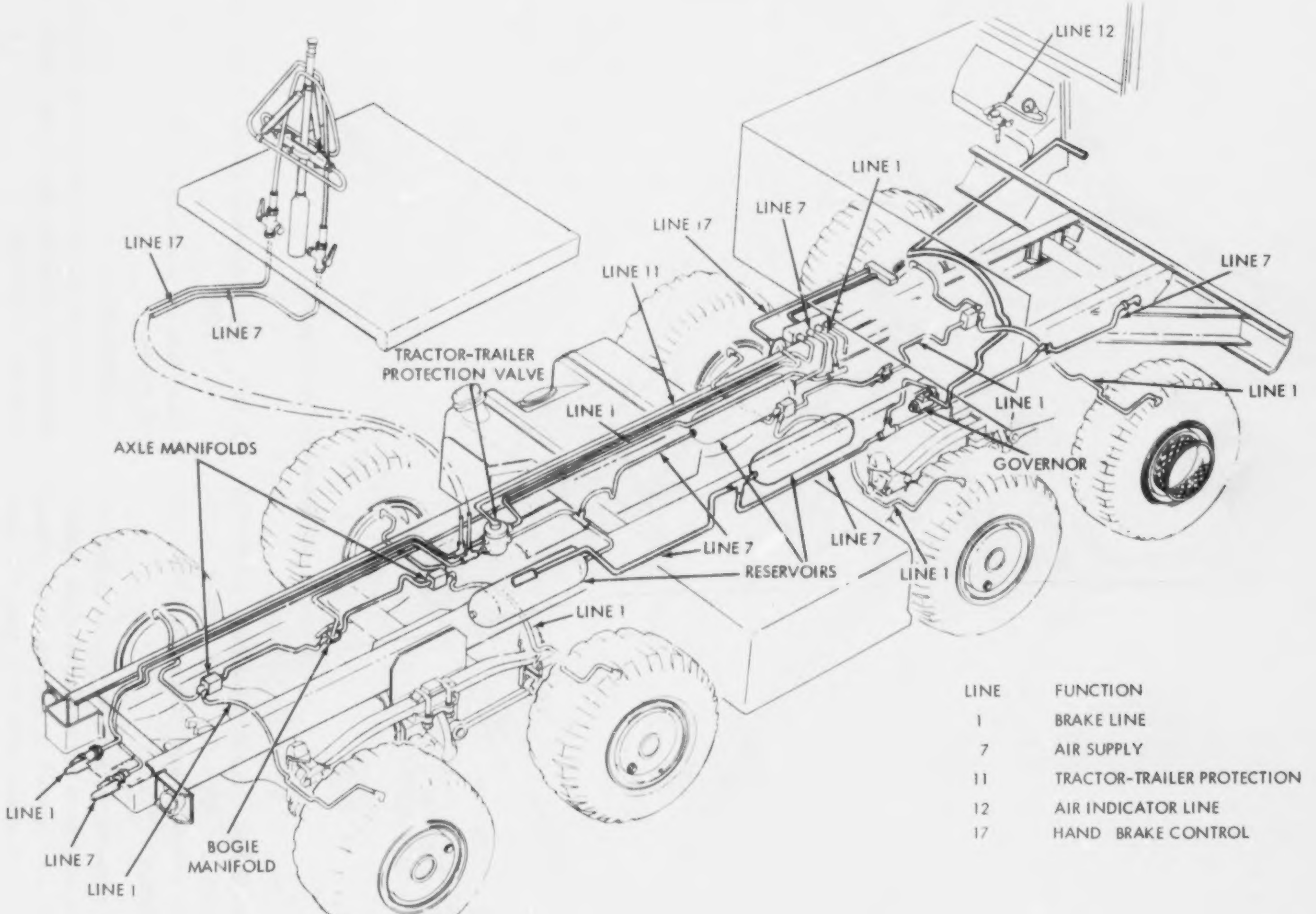
(2) Remove safety valve from air reservoir.


LINE 12
LINE 7
LINE 1
LINE 11
TRACTOR-TRAILER PROTECTION VALVE
LINE 7
LINE 1
LINE 1
AXLE MANIFOLDS
LINE 7
LINE 1
LINE 1
GOVERNOR
LINE 7
LINE 7
RESERVOIRS
LINE 1
LINE 1
LINE 1
LINE 7
BOGIE MANIFOLD
LINE 1

LINE	FUNCTION
1	BRAKE LINE
7	AIR SUPPLY
11	TRACTOR-TRAILER PROTECTION
12	AIR INDICATOR LINE

AT 12843

Figure 2–320. Service brake system—chassis (M656 and XM791).


LINE 12
LINE 17
LINE 7
TRACTOR-TRAILER PROTECTION VALVE
LINE 11
LINE 17
LINE 7
LINE 1
LINE 7
LINE 1
LINE 1
GOVERNOR
AXLE MANIFOLDS
LINE 1
LINE 7
RESERVOIRS
LINE 7
LINE 1
LINE 1
LINE 1
LINE 7
LINE 1
BOGIE MANIFOLD
AT 12844

LINE	FUNCTION
1	BRAKE LINE
7	AIR SUPPLY
11	TRACTOR-TRAILER PROTECTION
12	AIR INDICATOR LINE
17	HAND BRAKE CONTROL

Figure 2–321. Service brake system—chassis (XM757).

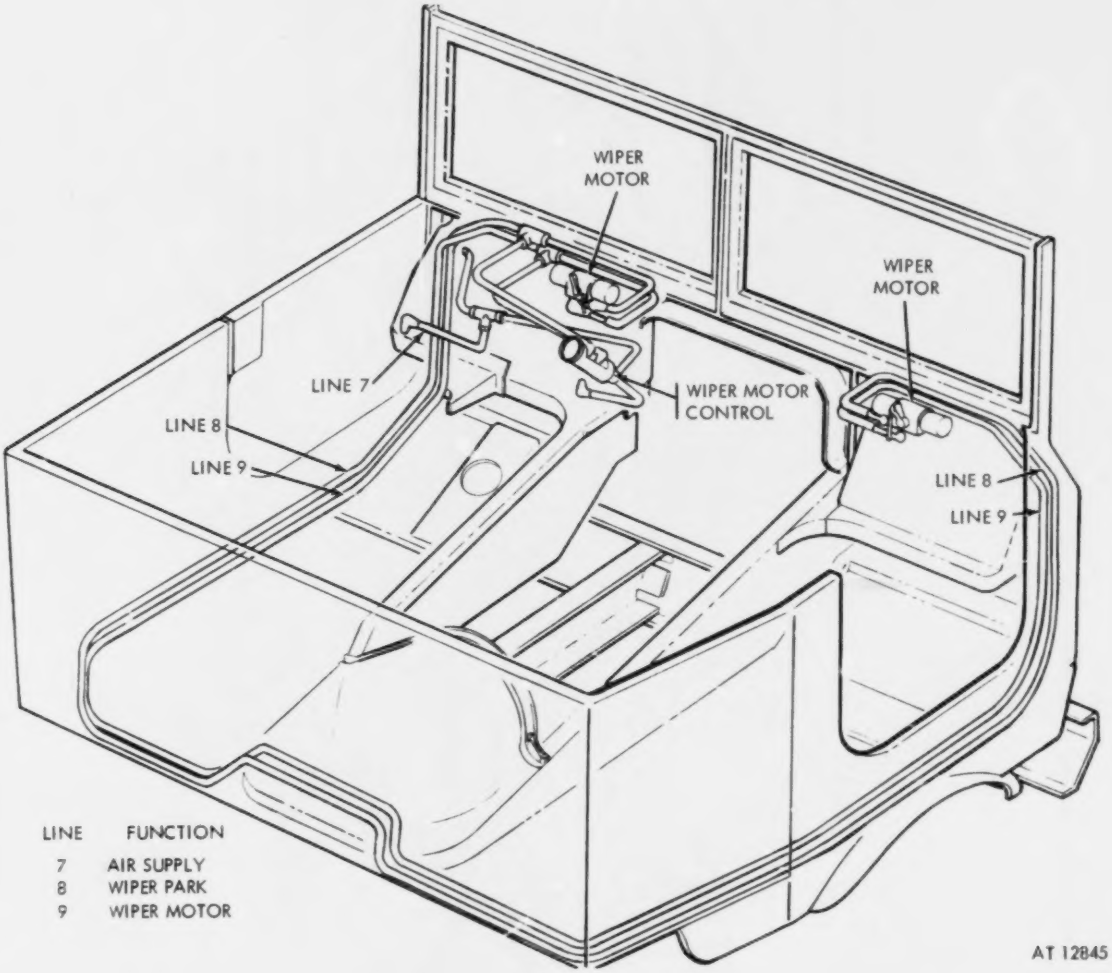

WIPER MOTOR
WIPER MOTOR
LINE 7
LINE 8
LINE 9
WIPER MOTOR CONTROL
LINE 8
LINE 9
LINE FUNCTION
7 AIR SUPPLY
8 WIPER PARK
9 WIPER MOTOR
AT 12845

Figure 2–322. Windshield wiper system.

b. Installation. Apply sealing compound (MIL–S–45180, type II) and install valve. Build air pressure and check for leaks with soap solution.

c. Adjustment. The air reservoir safety relief valve is factory adjusted and must operate when the air pressure in the reservoir exceeds 145–155 psi. Replace valve if it does not operate within these specifications.

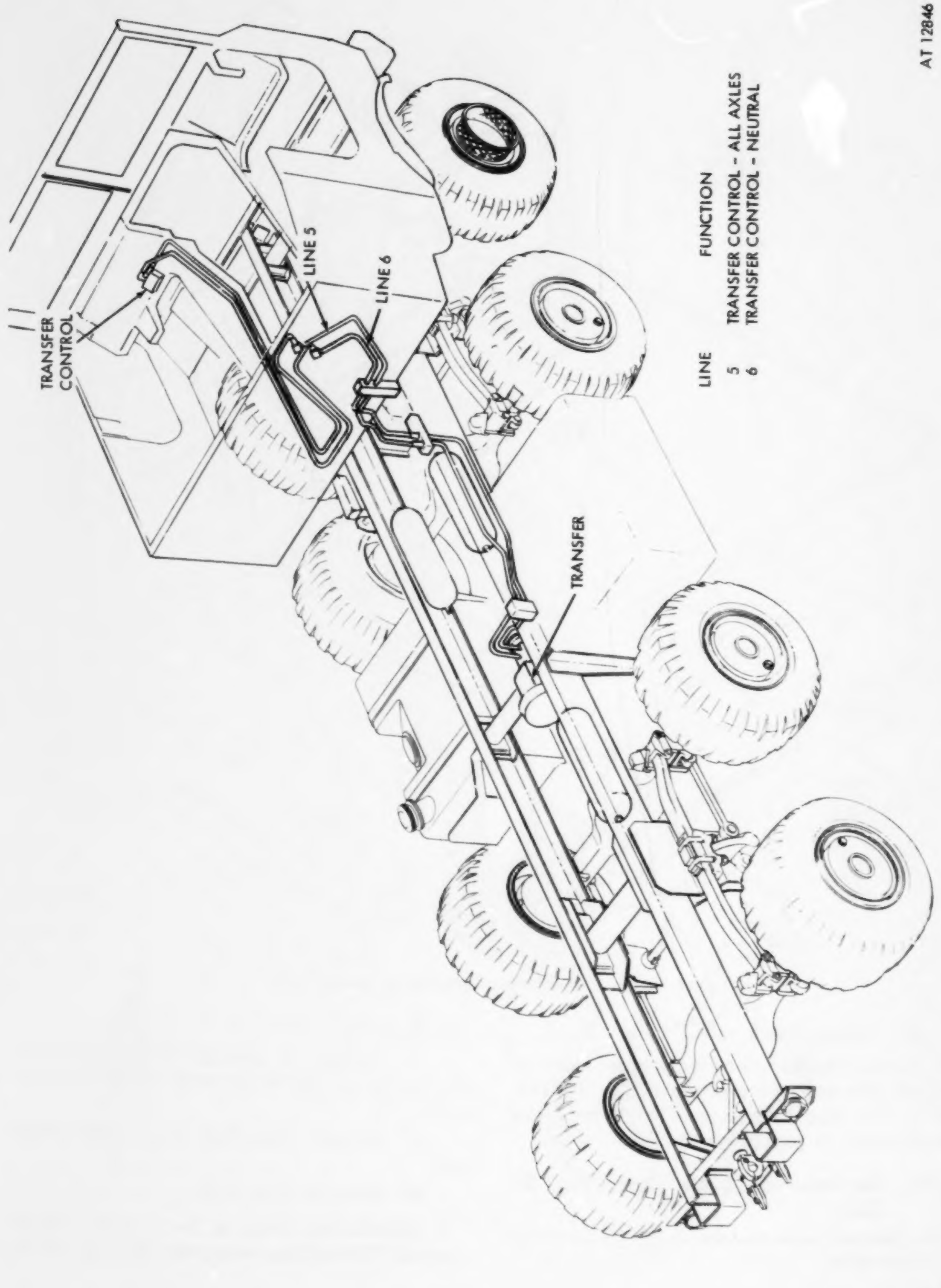
2–167. Air Reservoir Check Valve (Fig. 2–328)

Note. Removal procedures are similar for both reservoir valves.

a. Removal.

(1) Release air pressure in air system by alternately opening the drain cocks of the three air reservoirs.

(2) Disconnect air line.


TRANSFER CONTROL
LINE 5
LINE 6
TRANSFER

LINE	FUNCTION
5	TRANSFER CONTROL - ALL AXLES
6	TRANSFER CONTROL - NEUTRAL

AT 12846

Figure 2-323. Transfer control system.

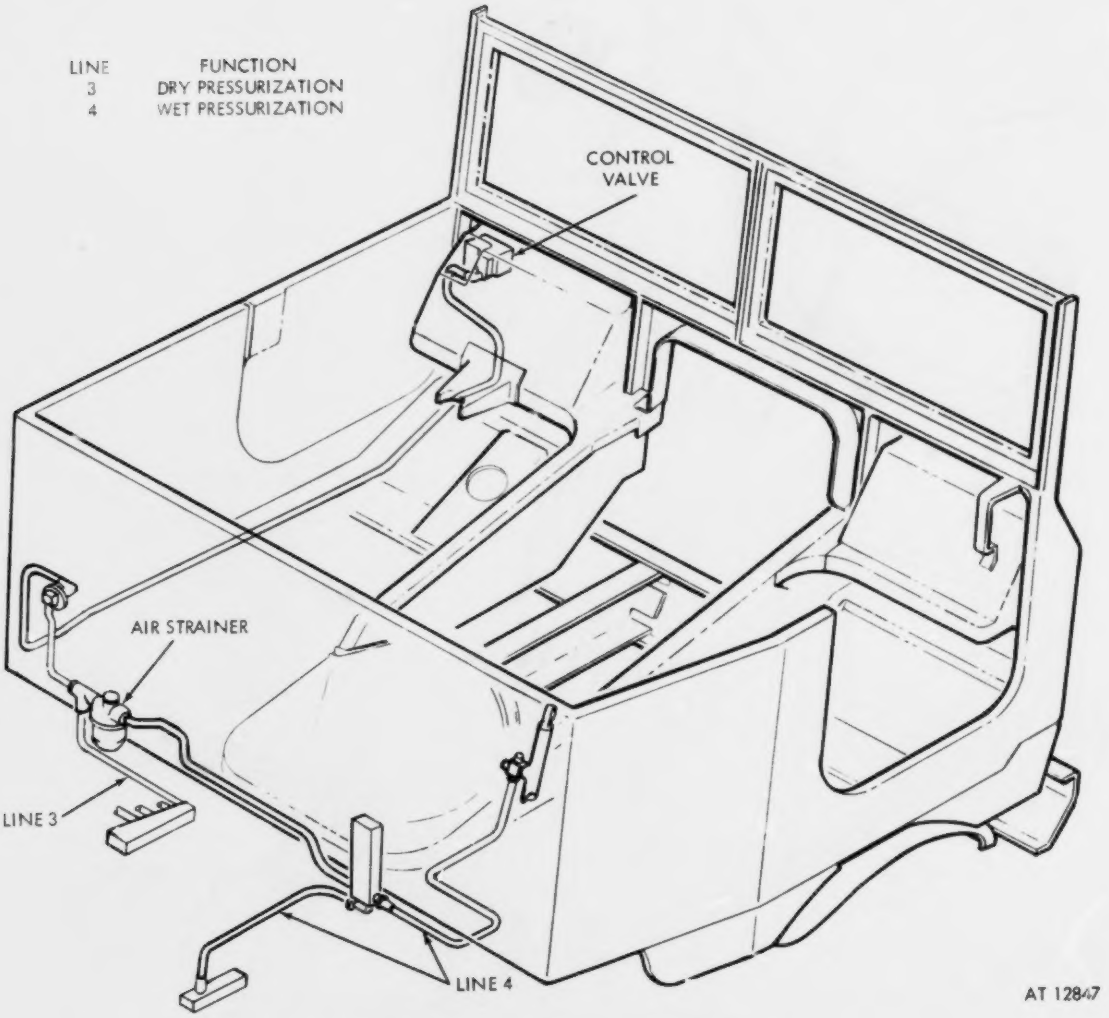

LINE FUNCTION
3 DRY PRESSURIZATION
4 WET PRESSURIZATION
CONTROL VALVE
AIR STRAINER
LINE 3
LINE 4
AT 12847

Figure 2-324. Component pressurization system—cab.

(3) Remove check valve.

b. Installation. Install in the reverse order of removal. Use sealing compound (MIL-S-45180, type II) on pipe threads and check for leaks as instructed in paragraph 2-165*c*.

2-168. Air Reservoir Drain Cocks (Fig. 2-327)

Note. Removal procedures are similar for all reservoir drain cocks.

a. Removal.

(1) Release air pressure in air system by alternately opening drain cocks of the three air reservoirs.

(2) Remove actuating wire from drain cock.

(3) Remove drain cock.

b. Installation. Install in the reverse order of removal. Use sealing compound (MIL-S-45180,

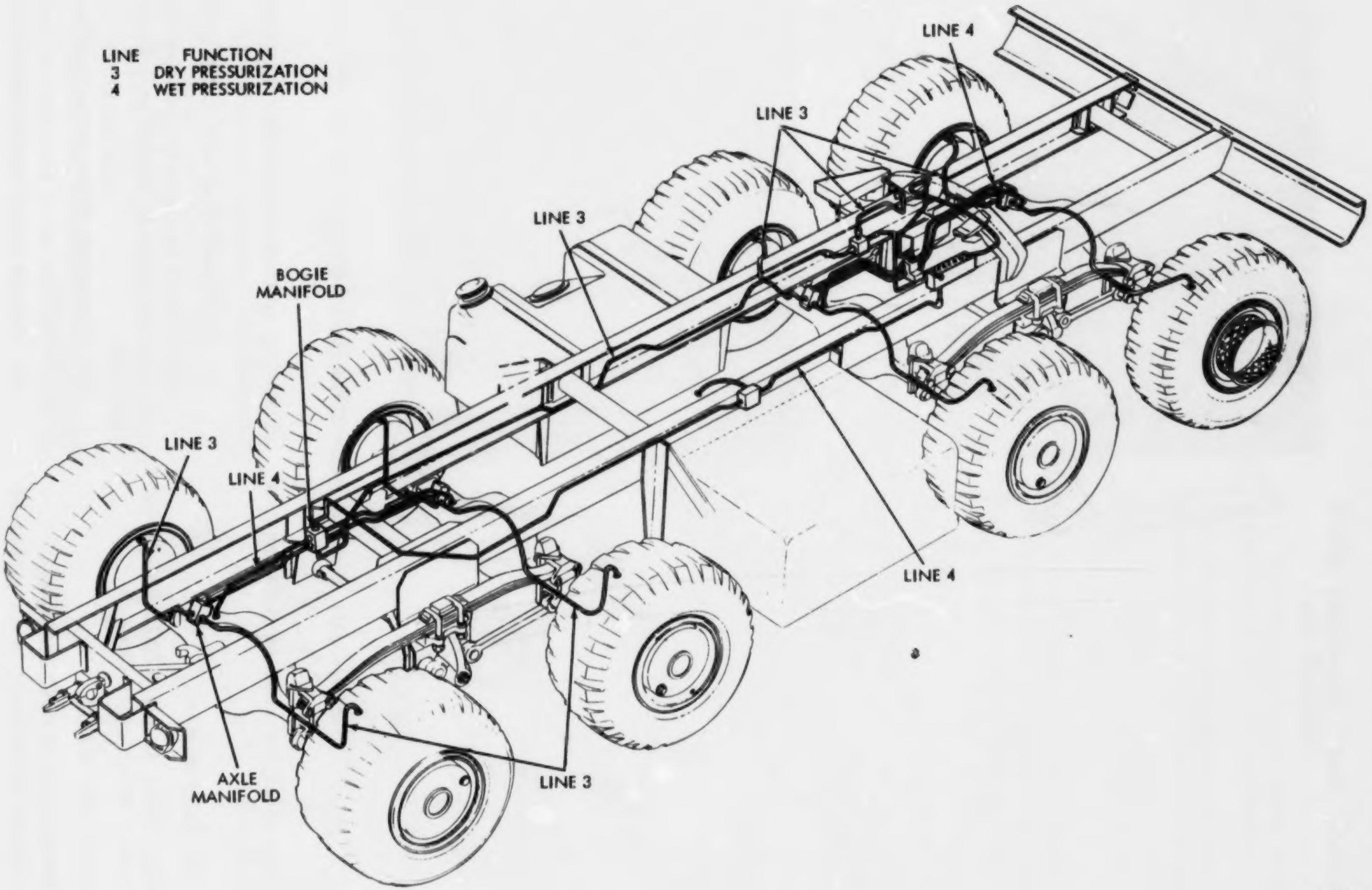

LINE FUNCTION
3 DRY PRESSURIZATION
4 WET PRESSURIZATION
LINE 4
LINE 3
LINE 3
BOGIE MANIFOLD
LINE 3
LINE 4
LINE 4
AXLE MANIFOLD
LINE 3
AT 12848

Figure 2-385. Component pressurization system—chassis.

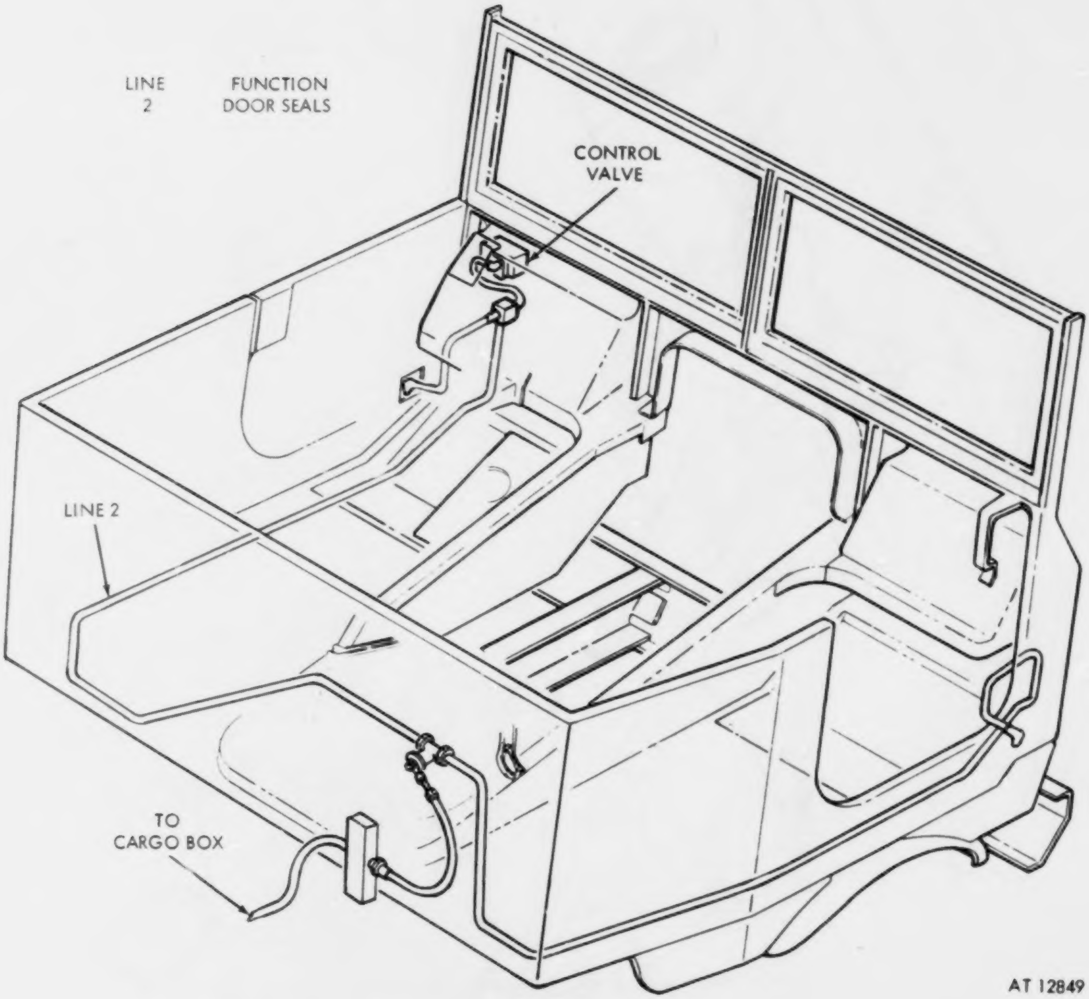

LINE
2
FUNCTION
DOOR SEALS
CONTROL
VALVE
LINE 2
TO
CARGO BOX
AT 12849

Figure 2-326. Door seals pressurization system—(M656).

type II) and check for leaks as instructed in paragraph 2-165*c*.

2-169. Air Reservoirs

a. Service. Refer to LO 9-2320-230-12 for daily service of the air reservoirs.

b. Removal (*Fig. 2-327*).

Note. Removal of all reservoirs is similar.

(1) Release air pressure in air system by alternately opening drain cocks of the three air reservoirs.

(2) Disconnect inlet and outlet tubes.

(3) Remove two screws, lockwashers and nuts securing clamp to bracket on both ends of reservoir.

(4) Disconnect drain cock actuating wire from valve end.

(5) Remove clamps and reservoir.

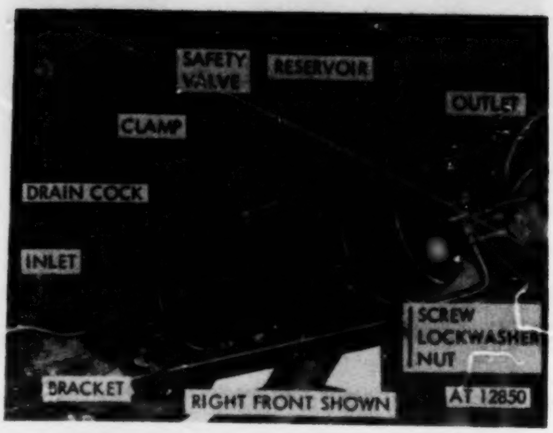

SAFETY VALVE
RESERVOIR
OUTLET
CLAMP
DRAIN COCK
INLET
SCREW
LOCKWASHER
NUT
BRACKET
RIGHT FRONT SHOWN
AT 12850

Figure 2-327. Air reservoirs, removal and installation.

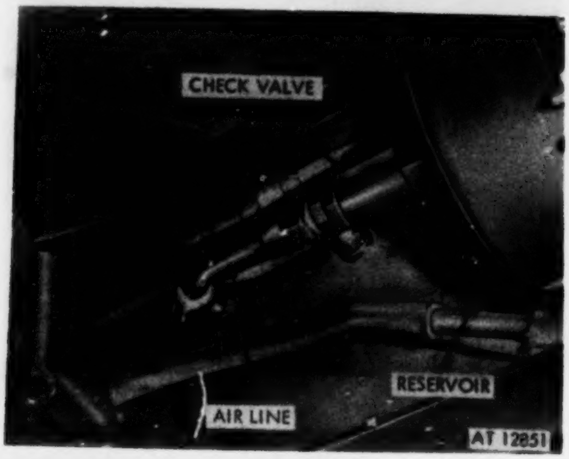

CHECK VALVE
RESERVOIR
AIR LINE
AT 12851

Figure 2-328. Air reservoir check valve, removal and installation.

c. Disassembly (Fig. 2-329).

(1) *Right front reservoir.* Remove safety valve, elbows, tee and drain cock.

(2) *Right rear reservoir.* Remove check valve, elbow, plug, drain cock and adapter.

(3) *Left reservoir.* Remove plug, check valve and drain cock.

d. Assembly and installation. Assemble and install air reservoirs in the reverse order of disassembly and removal.

2-170. Instrument Panel Control Valves and Manifold

a. Air Pressure Gage. Refer to paragraph 2-94*h* for removal and installation.

b. Pressurization Switch (M656). Refer to paragraph 2-95*a* for removal and installation.

c. Pressurization Switch (XM757 and XM791). Refer to paragraph 2-95*b* for removal and installation.

d. Truck-Tractor Protection Switch. Refer to paragraph 2-95*f* for removal and installation.

e. Transfer Case Axle Selector. Refer to

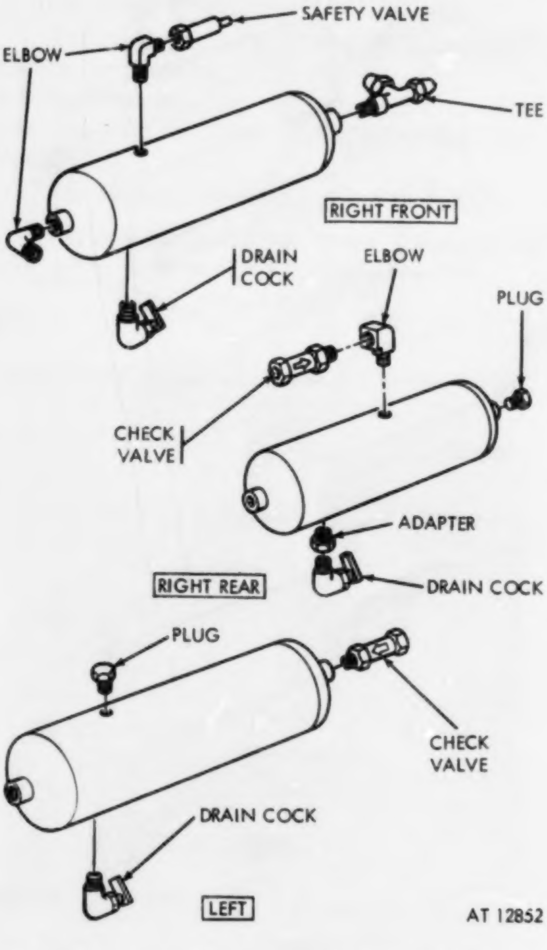

SAFETY VALVE
ELBOW
TEE
RIGHT FRONT
DRAIN COCK
ELBOW
PLUG
CHECK VALVE
ADAPTER
RIGHT REAR
DRAIN COCK
PLUG
CHECK VALVE
DRAIN COCK
LEFT
AT 12852

Figure 2-329. Air reservoirs, disassembly and assembly.

paragraph 2-94 for removal and installation.

f. Check Valve (Fig. 2-330).

(1) *Removal.*

(*a*) Release air pressure in air system by alternately opening drain cocks in three air reservoirs.

(*b*) Disconnect three air lines from cross and elbow.

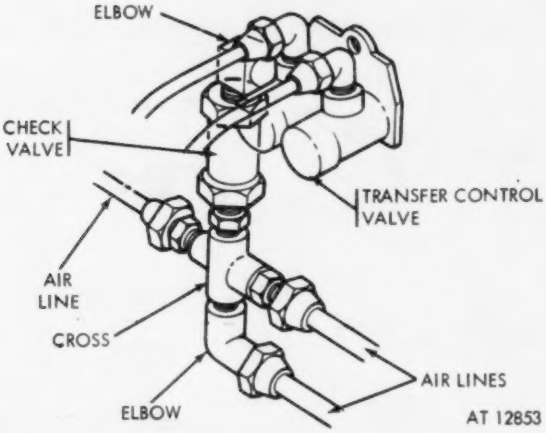

ELBOW
CHECK VALVE
TRANSFER CONTROL VALVE
AIR LINE
CROSS
AIR LINES
ELBOW
AT 12853

Figure 2-330. Instrument panel check valve, removal and installation.

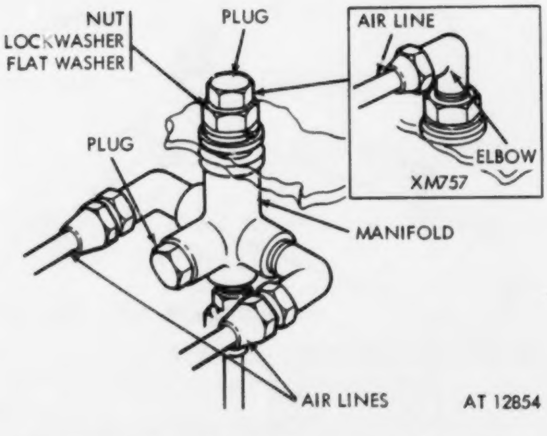

NUT
LOCKWASHER
FLAT WASHER
PLUG
AIR LINE
PLUG
ELBOW
XM757
MANIFOLD
AIR LINES
AT 12854

Figure 2-331. Instrument panel air supply manifold, removal and installation.

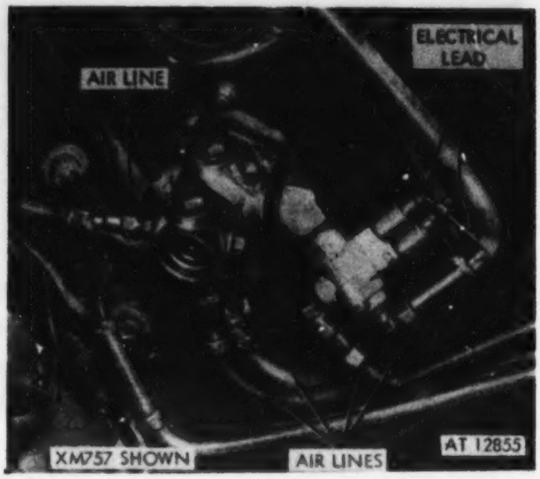

ELECTRICAL LEAD
AIR LINE
XM757 SHOWN
AIR LINES
AT 12855

Figure 2-332. Treadle valve, removal and installation.

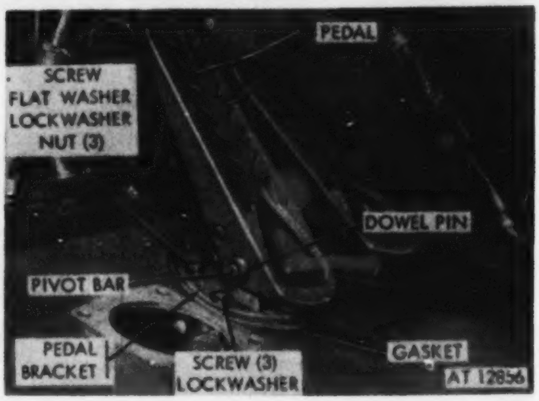

PEDAL
SCREW
FLAT WASHER
LOCKWASHER
NUT (3)
DOWEL PIN
PIVOT BAR
PEDAL BRACKET
SCREW (3)
LOCKWASHER
GASKET
AT 12856

Figure 2-333. Treadle valve pedal, removal and installation.

(*c*) Remove check valve, with cross and elbow attached, from elbow.

(*d*) Remove check valve from cross and elbow.

(2) *Installation.* Install check valve in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

g. Air Supply Manifold (Fig. 2-231).

(1) *Removal.*

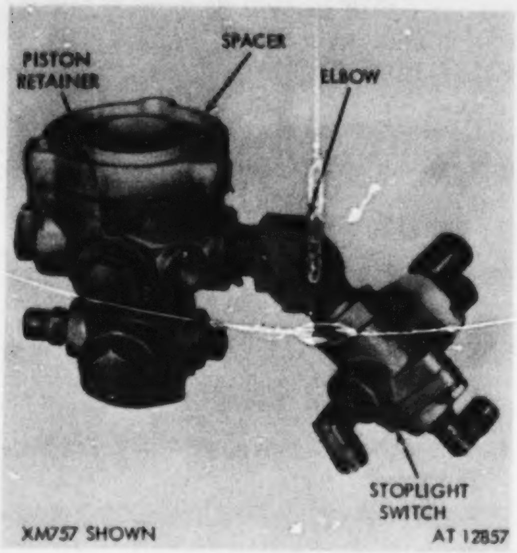


Figure 2-334. Brake valve, disassembly and assembly.

(*a*) Release air pressure in air system.

(*b*) Disconnect three air lines.

(*c*) Remove plug in top of manifold (M656 and XM791). Remove air line and elbow in top of manifold (XM757).

(*d*) Remove nut, lockwasher and flat washer securing manifold to instrument panel and remove manifold.

(*e*) Remove plugs and fittings from manifold.

(2) *Installation.* Install manifold in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

2-171. Treadle Valve

Note. **The removal procedures for all models are similar. The XM757 includes hand control lines to the stoplight switch which are not on the M656 and XM791.**

a. Removal (Figs. 2-332 and 2-333).

(1) Release air pressure in air system.

(2) Disconnect three air lines (five air lines on XM757).

(3) Disconnect electrical leads.

(4) Remove dowel pin and pivot bar securing pedal to bracket and remove pedal.

(5) Remove three screws and lockwashers securing pedal bracket to brake valve and remove valve.

(6) Remove three screws, flat washers, lockwashers and nuts securing pedal bracket to cab floor.

(7) Remove pedal bracket and discard gasket.

b. Disassembly (Fig. 2-334).

(1) Remove stoplight switch and elbow (XM757). Remove stoplight switch and adapter (M656 and XM791).

(2) Remove spacer and piston retainer.

(3) Remove and discard piston assembly, packing and spring (fig. 2-335).

(4) Remove and discard retaining ring and washer retaining valve assembly (fig. 2-336).

(5) Remove valve assembly (fig. 2-337).

c. Assembly. Assemble brake valve, using new parts, in reverse order of disassembly.

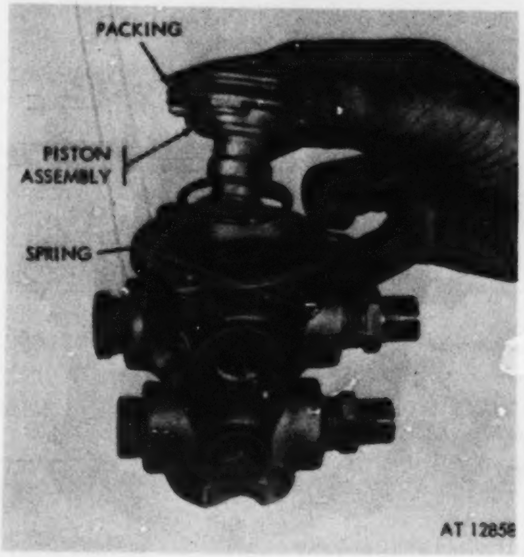


Figure 2-335. Brake valve piston assembly, removal and installation.

d. Installation. Using new pedal bracket gasket, install in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

2-172. Hand Control Brake Valve (Fig. 2-338)

a. Removal.

(1) Release pressure in air system.

(2) Disconnect two air lines and remove two adapters.

(3) Remove two screws and lockwashers securing clamp to valve.

(4) Remove clamp and valve.

b. Installation. Install valve in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

2-173. Trap Assembly and Air Separator

a. Trap Assembly Removal (Fig. 2-339)

(1) Release pressure in air system.

(2) Disconnect two air lines and a hose.

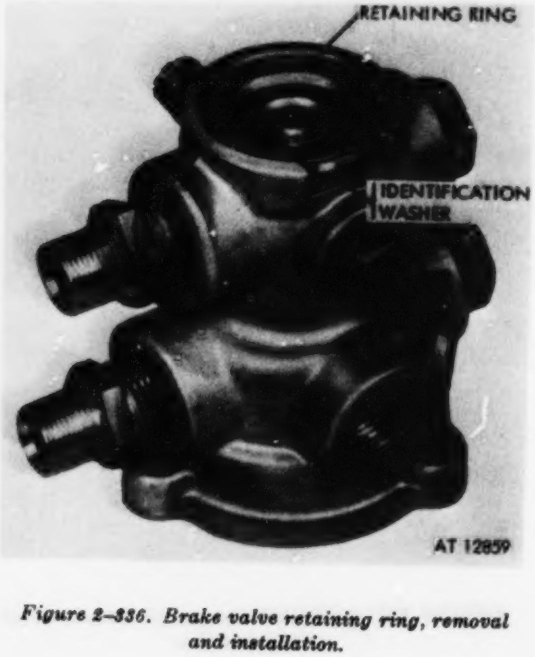


Figure 2-336. Brake valve retaining ring, removal and installation.

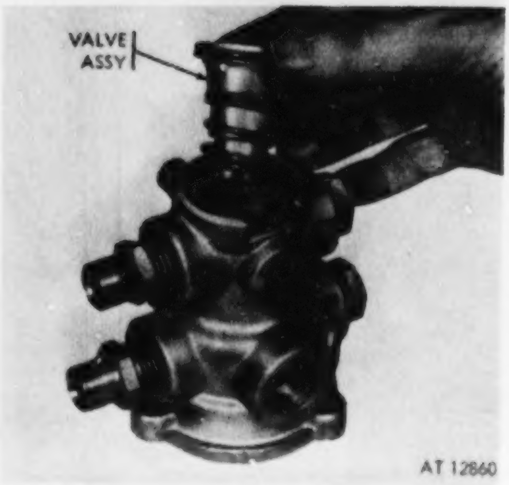


Figure 2-337. Brake valve, valve assembly, removal and installation.

(3) Remove two screws, flat washers and lockwashers securing trap assembly to bracket, remove trap.

(4) Remove tee from trap assembly.

b. Installation. Install trap assembly in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for air leaks as instructed in paragraph 2-165*c*.

c. Air Separator Removal. The air separator is mounted under the instrument panel on the driver side of the vehicle.

(1) Release pressure in air system.

(2) Disconnect inlet and outlet air hoses from air separator.

(3) Remove two screws and lockwashers securing air separator to bracket, remove air separator.

d. Installation. Install trap assembly in the reverse order of removal. Use sealer (MIL-S-45180, type II), check for air leaks as instructed in paragraph 2-165*c*.

2-174. Tractor Trailer Protection Valve (Fig. 2-340)

a. Removal.

(1) Release pressure in air system.

(2) Disconnect five air lines (M656 and XM791) or seven air lines (XM757).

(3) Remove two screws, flat washers, lockwashers and nuts securing valve to frame rail. Remove valve.

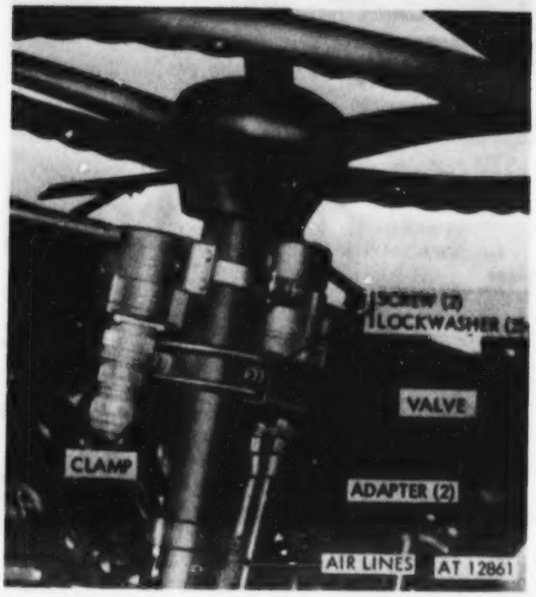

SCREW (2)
LOCKWASHER (2)
VALVE
CLAMP
ADAPTER (2)
AIR LINES
AT 12861

Figure 2-338. Handbrake control valve, removal and installation.

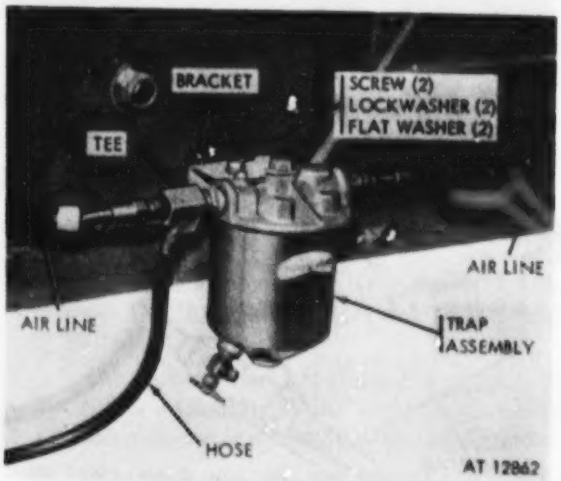

BRACKET
SCREW (2)
LOCKWASHER (2)
FLAT WASHER (2)
TEE
AIR LINE
AIR LINE
TRAP ASSEMBLY
HOSE
AT 12862

Figure 2-339. Trap assembly, removal and installation.

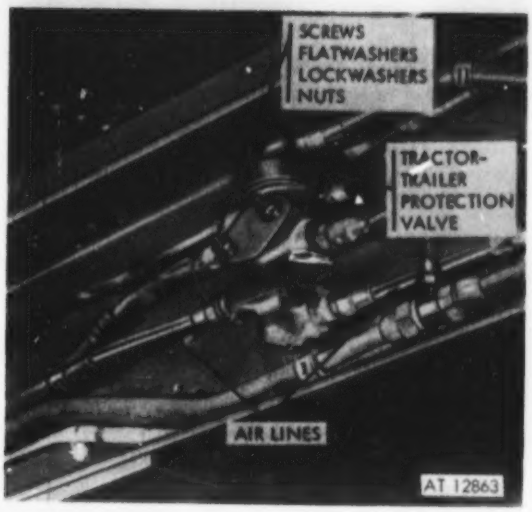

SCREWS
FLATWASHERS
LOCKWASHERS
NUTS
TRACTOR-TRAILER PROTECTION VALVE
AIR LINES
AT 12863

Figure 2-340. Tractor-trailer protection valve, removal and installation.

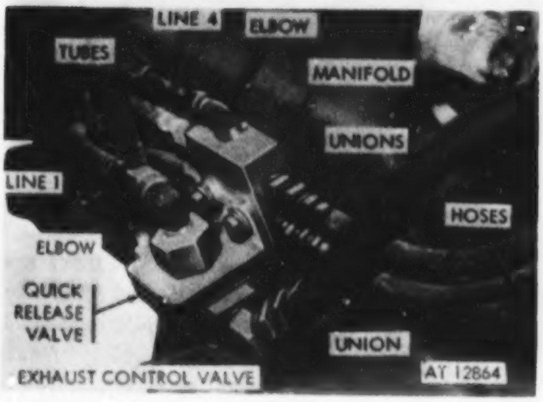

LINE 4
ELBOW
TUBES
MANIFOLD
UNIONS
LINE 1
HOSES
ELBOW
QUICK RELEASE VALVE
UNION
EXHAUST CONTROL VALVE
AT 12864

Figure 2-341. Bogie manifold and quick release valve, removal and installation.

(4) Remove five adapters (M656 and XM791) or three adapters and two tees (XM757).

b. Installation. Install valve in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

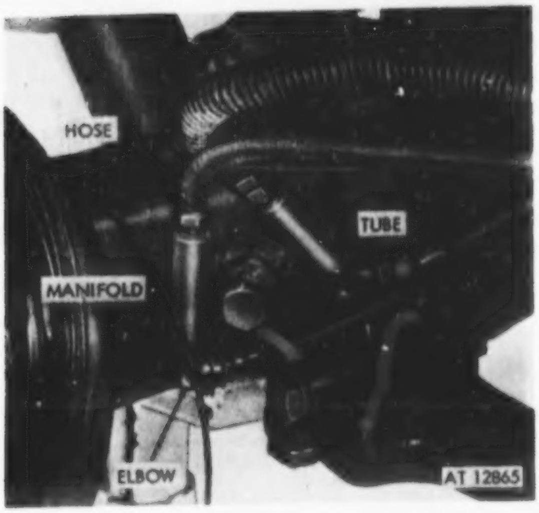


Figure 2-342. Steering knuckle manifold, removal and installation.

2-175. Bogie Manifold and Quick Release Valve (Fig. 2-341)

Note. Removal of front and rear bogie manifolds and quick release valves is similar.

a. Removal.

(1) Release pressure in air system.

(2) Disconnect three tubes and six hoses.

(3) Remove three elbows and six unions from manifold and valve.

(4) Remove two screws, flat washers and lockwashers mounting manifold and quick release valve to bogie bracket.

(5) Remove manifold and quick release valve.

(6) Remove exhaust control valve from quick release valve.

b. Installation. Install in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

2-176. Steering Knuckle Manifolds (Fig. 2-342)

a. Removal.

(1) Release pressure in air system.

(2) Disconnect hose and tube, and remove elbow.

(3) Remove screw and lockwasher securing manifold to axle housing.

(4) Remove manifold.

b. Installation. Install manifold in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

2-177. Axle Manifolds (Fig. 2-343)

a. Removal.

Note. Removal procedures for front and rear axles is similar.

(1) Release pressure in air system.

(2) Disconnect four air lines and two air-hoses.

(3) Remove elbow, tee, adapter, and two unions.

(4) Remove two screws and lockwashers securing manifold, and remove manifold.

b. Installation. Install manifold in reverse order of removal. Use sealer (MIL-S-45180, type II) and check for leaks as instructed in paragraph 2-165*c*.

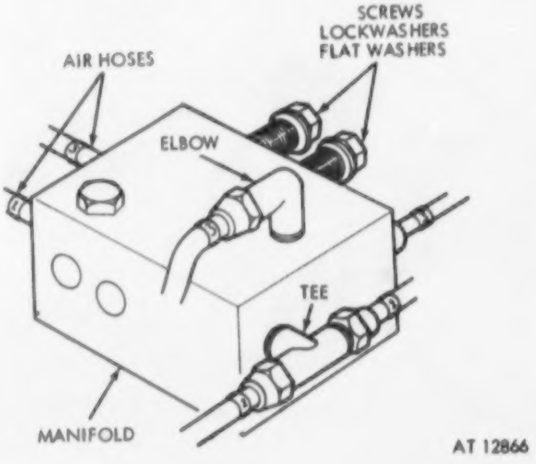


Figure 2-343. Axle manifold, removal and installation.

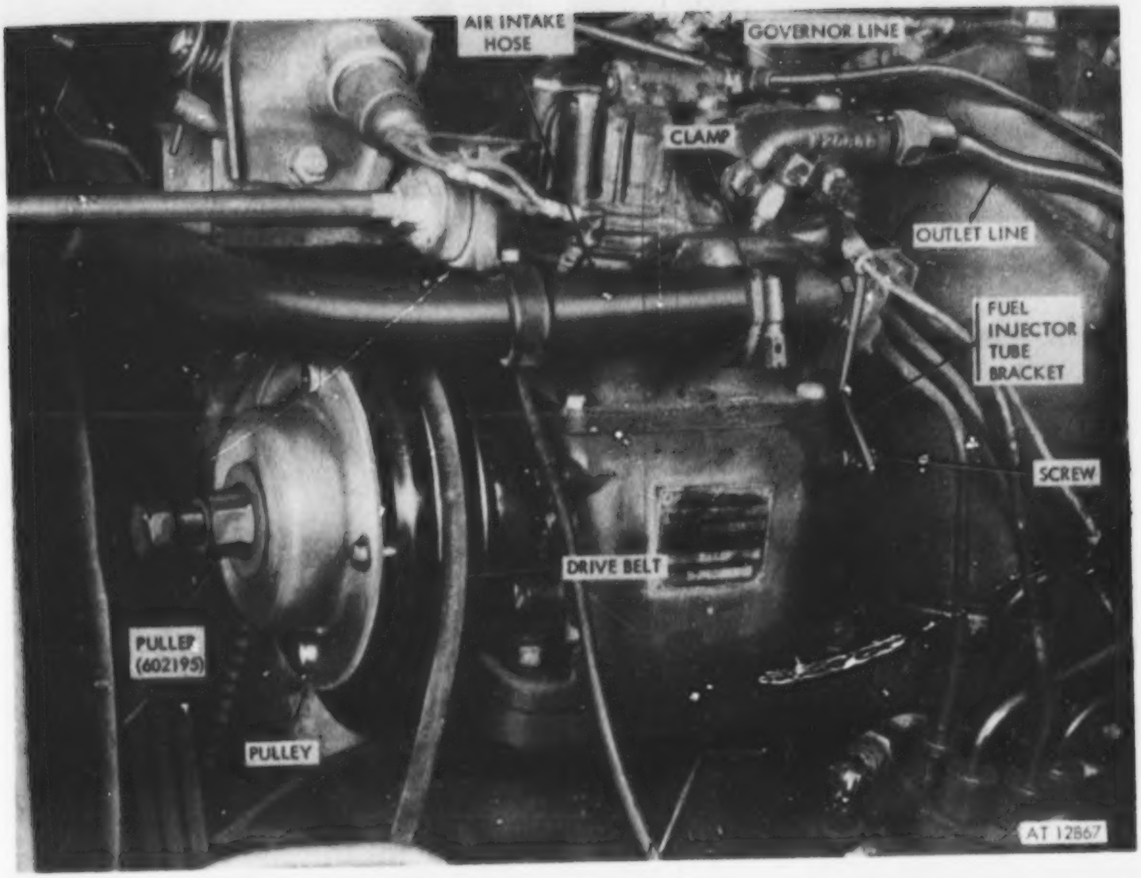

AIR INTAKE HOSE
GOVERNOR LINE
CLAMP
OUTLET LINE
FUEL INJECTOR TUBE BRACKET
SCREW
DRIVE BELT
PULLER (602195)
PULLEY
AT 12867

Figure 2-344. Air compressor belt and pulley, removal and installation.

2-178. Air Compressor Drive Belt and Pulley

a. Removal.

(1) Loosen the fan belt adjusting idler and remove the two fan drive belts.

(2) Loosen the alternator assembly and remove the three alternator and water pump drive belts.

(3) Loosen the self-locking nut securing the pulley assembly to the compressor crankshaft.

(4) Back nut off compressor crankshaft until approximately three threads remain holding the nut.

(5) Install the compressor pulley puller (02978-602195) (fig. 2-344) into the center threaded section of the outer pulley flange.

(6) Tighten the puller center bolt until the pulley snaps loose from the compressor crankshaft.

(7) Remove the puller and the compressor pulley nut.

(8) Remove the compressor pulley assembly with the drive belt attached and slide the pulley assembly off the compressor crankshaft.

(9) Remove the compressor pulley belt from the engine crankshaft pulley.

(10) Install two 3/8-16 x 3/4 inch (MS35295-58) jack screws in the jack screw

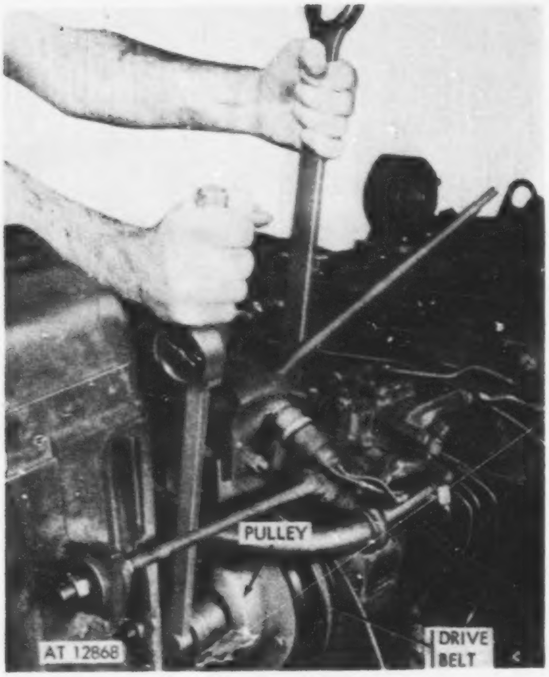

PULLEY
DRIVE BELT
AT 12868

Figure 2-345. Air compressor pulley installation.

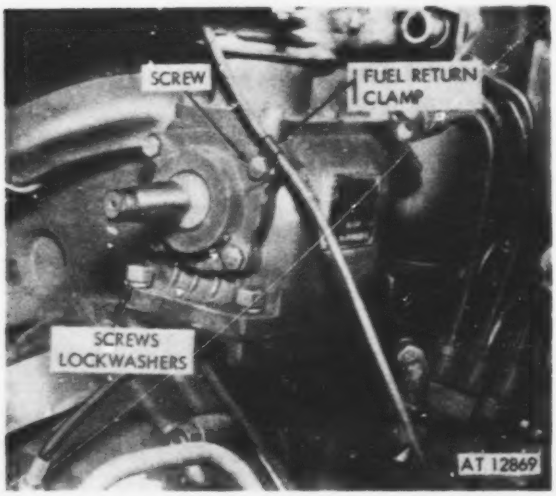

SCREW
FUEL RETURN CLAMP
SCREWS LOCKWASHERS
AT 12869

Figure 2-346. Air compressor, removal and installation.

holes located in the rear compressor pulley flange.

(11) Tighten jack screws and spread pulley flange apart, freeing the compressor drive belt.

(12) Remove drive belt from compressor pulley assembly and inspect belt for wear, cracks, and length. Replace belt if badly worn or damaged.

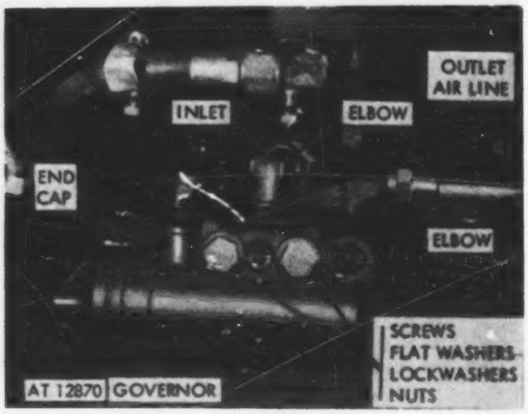

INLET
ELBOW
OUTLET AIR LINE
END CAP
ELBOW
SCREWS
FLAT WASHERS
LOCKWASHERS
NUTS
AT 12870
GOVERNOR

Figure 2-347. Air governor, removal and installation.

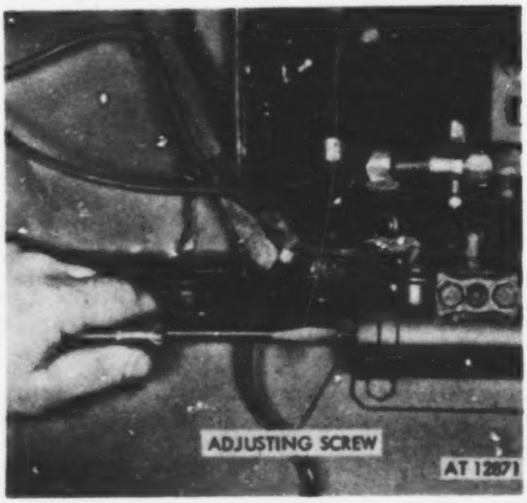

ADJUSTING SCREW
AT 12871

Figure 2-348. Air governor adjustment.

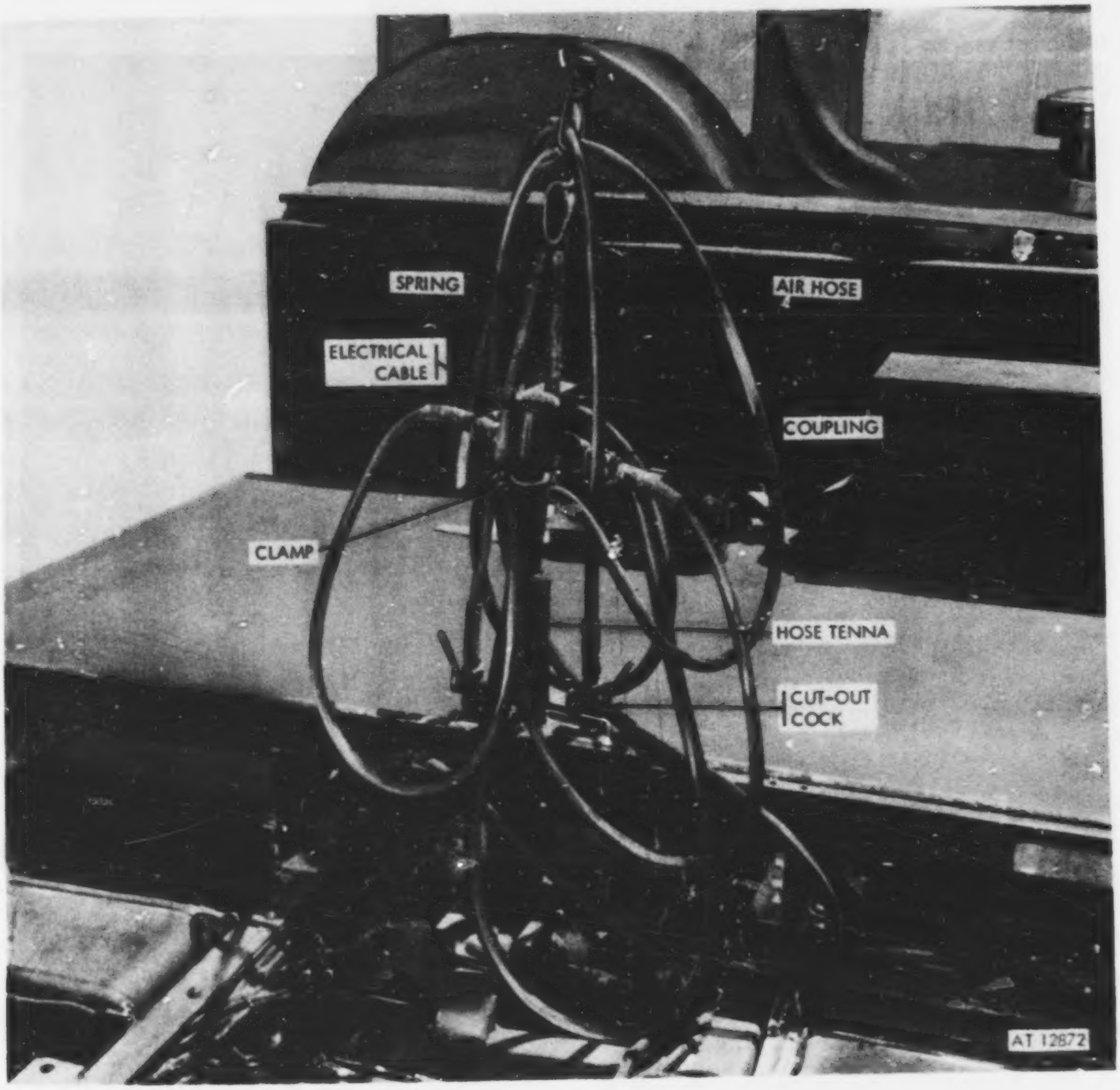

SPRING
AIR HOSE
ELECTRICAL CABLE
COUPLING
CLAMP
HOSE TENNA
CUT-OUT COCK
AT 12872

Figure 2-349. Hose tenna assembly, removal and installation.

b. Installation. Install pulley and belt in reverse order of removal. Tighten pulley retaining nut to 100 lb-ft (fig. 2-345).

Note. Compressor drive belt tension is self-adjusting.

2-179. Air Compressor (Fig. 2-344)

a. Removal.

(1) Release pressure in air system by alternately opening drain cocks on three air reservoirs.

(2) Remove drive belt and pulley (para 2-178).

(3) Loosen clamp and remove air intake hose.

(4) Disconnect outlet line and governor line.

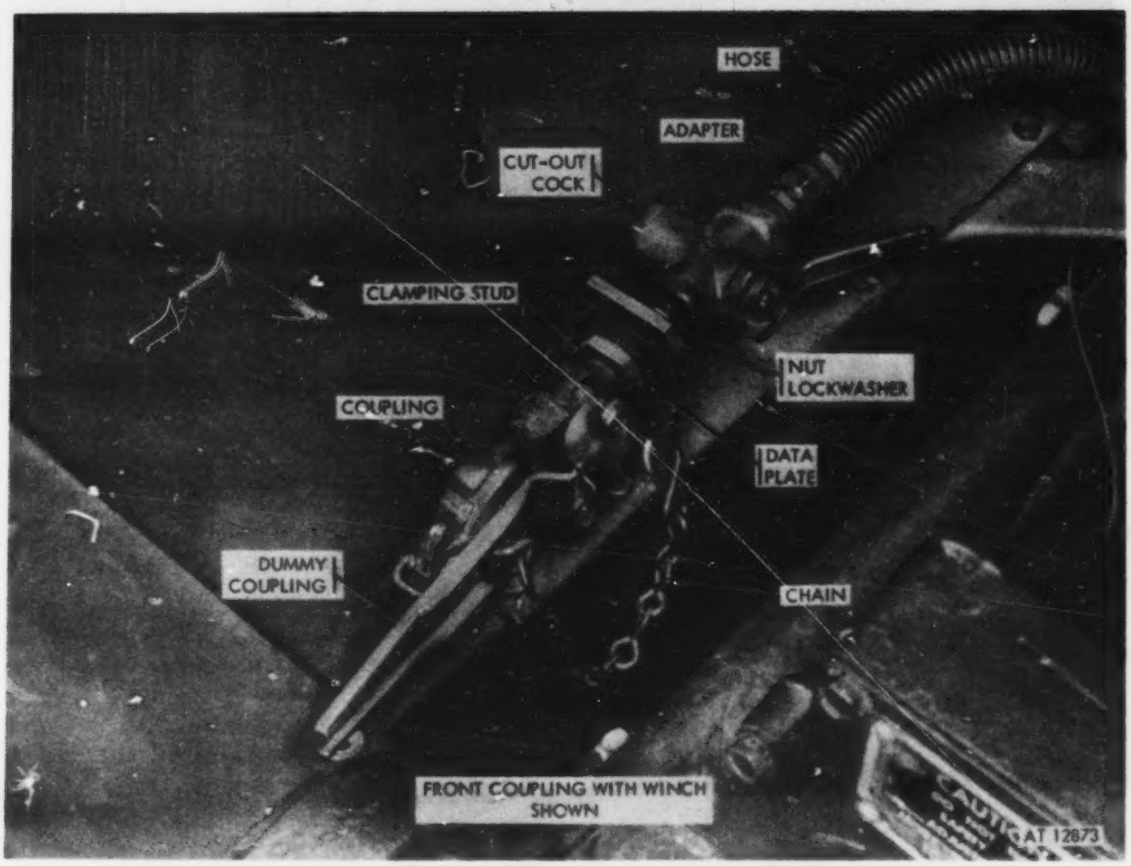

HOSE
ADAPTER
CUT-OUT COCK
CLAMPING STUD
NUT LOCKWASHER
COUPLING
DATA PLATE
DUMMY COUPLING
CHAIN
FRONT COUPLING WITH WINCH SHOWN
AT 12873

Figure 2-350. Air couplings, removal and installation.

(5) Remove screw retaining fuel injector tube bracket.

(6) Remove screw retaining fuel return clamp (fig. 2-346).

(7) Remove four screws and lockwashers securing compressor (fig. 2-346).

(8) Remove compressor.

b. Installation. Install air compressor in reverse order of removal. Use sealer (MIL-S-45180, type II) on pipe threads of air connections and check for leaks as instructed in paragraph 2-165*c*.

2-180. Air Governor (Fig. 2-347)

a. Removal.

(1) Release pressure in air system by alternately opening drain cocks on three air reservoirs.

(2) Disconnect inlet and outlet air lines and remove fittings.

(3) Remove two screws, flat washers, lockwashers and nuts securing governor. Remove governor.

b. Installation. Install in the reverse order of removal. Use sealer MIL-S-45180, type II) on pipe threads and check for leaks as prescribed in paragraph 2-165*c*.

c. Adjustment.

(1) Remove governor housing end cap (fig. 2-347).

(2) Loosen lock nut on adjusting screw.

(3) Turn adjusting screw to raise or lower air system pressure (fig. 2-348). Pressure must be 105-125 psi on pressure gage in vehicle cab.

(4) Tighten lock nut on adjusting screw when correct air pressure is obtained.

(5) Install governor housing end cap.

2-181. Hose Tenna Assembly, Hoses and Fittings (Fig. 2-349)

a. Removal.

(1) Release pressure in air system.

(2) Disconnect electrical cable from stowage clip and remove clip.

(3) Remove two couplings from airhose stowage bracket.

(4) Remove couplings from hoses.

(5) Remove two springs supporting airhoses.

(6) Remove clamp, screw, lockwasher and nut from each hose.

(7) Remove two hoses from cut-out cocks and remove cocks.

(8) Remove nut and flat washer from bolt on underside of platform securing hose tenna. Remove hose tenna and washer.

b. Installation. Install in reverse order of removal. Use sealer (MIL-S-45180, type II) on pipe threads and check for leaks as instructed in paragraph 2-165c.

2-182. Air Couplings (Fig. 2-350)

a. Removal.

Note. Removal of all couplings is similar.

(1) Release pressure in air system.

(2) Disengage dummy coupling; disconnect chain and remove dummy coupling.

(3) Remove coupling and data plate.

(4) Disconnect hose and remove adapter. Rear couplings have tubes and elbows which must be removed rather than hoses.

(5) Remove cut-out cock from clamping stud.

(6) Remove elbow from front coupling (vehicles w/o winch).

b. Installation. Install in reverse order of removal. Use sealer (MIL-S-45180, type II) on pipe threads and check for leaks as instructed in paragraph 2-165c.

Section XXIX. WHEELS AND TIRES

2-183. General

This section contains instructions for the removal and installation of the wheels and tires.

2-184. Wheel and Tire (Fig. 2-351)

a. Removal.

(1) Use wheel chocks to prevent vehicle from rolling and raise axle until tire is off ground.

(2) Remove eight nuts securing wheel and tire to hub, and remove wheel and tire.

(3) Remove cap, valve extension and valve core (fig. 2-352) releasing air pressure in tire.

(4) Move tire bead into drop center and remove ring and tire from wheel.

(5) Remove nut and valve from wheel.

b. Inspection and Repair.

(1) Replace any tire with cuts on tread or side wall. If uneven wear is indicated, check toe-in adjustment (para 2-196).

(2) Check pressures when tire is cold. Dismount any tire showing unusual pressure loss and examine tire for cause. Repair tire (TM 9-1871) or replace, as necessary.

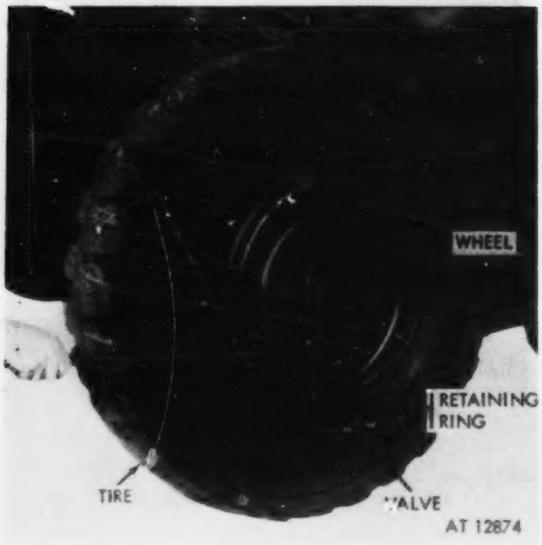


Figure 2-351. Wheel and tire, removal and installation.

(3) Inflate all tires to equal pressure, as unequal pressures will affect steering and braking adversely. Inflate tires to pressures designated on vehicle data plate. Under inflated tires are easily damaged. Install all valve caps to help prevent air loss.

c. Installation.

(1) Install wheel and tire in reverse reverse order of removal.

(2) Apply soap solution to tire bead and wheel. Use a bead expander to assist in installation.

(3) Tighten wheel nut to 250-270 lb-ft.

2-185. Hub Wheel Stud

a. Removal.

(1) Remove hub as instructed in paragraph 2-148.

(2) Drive out wheel stud.

b. Installation.

(1) Insert new wheel stud in wheel hub opening and engage serrations.

(2) Install a wheel mounting nut on stud with nut in reversed position.

(3) Tighten nut and draw stud into place. Remove nut.

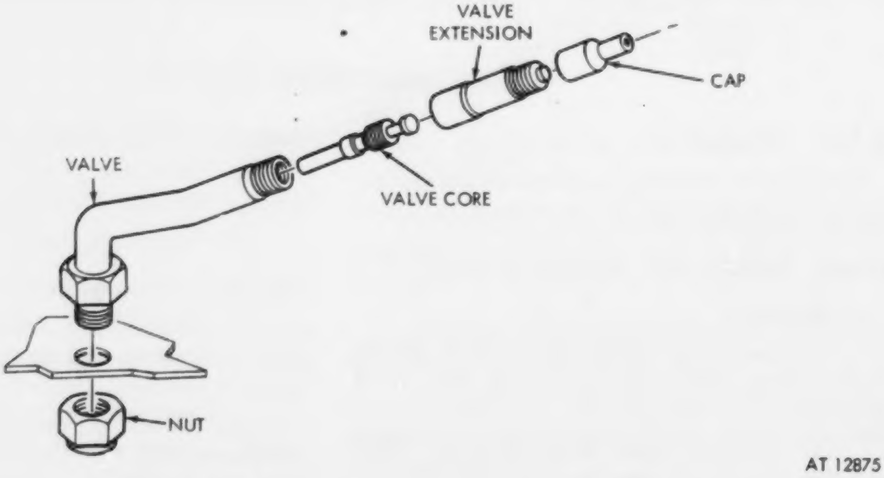


Figure 2-352. Valve assembly, removal and installation.

Section XXX. STEERING SYSTEM

2-186. General

This section contains service, removal, installation, and adjustment procedures for the steering system components (fig. 2-353). These components consist of the steering linkage, tie rods, tie rod ends, idler arm and seals, steering wheel, power steering cylinder and control valve assembly, oil reservoir and oil hoses and fittings.

2-187. Steering Linkage Replacement

a. General. The steering linkage (figs. 2-353 and 2-354) consists of tie rods, drag links, and the front and rear reach rods.

Note. Before removing any steering linkage, the front wheels must be placed in a straight forward position.

b. Removal. Removal procedures for the front and rear reach rods are the same.

(1) Remove cotter pin and nut from each end stud of rod to be removed.

(2) Using knock out adapter (11614133) and knock out bar (11614134), loosen rod end stud (fig. 2-355), remove adapter and disconnect rod. Using same procedure, loosen opposite end of rod and remove rod. Discard seals from rod end studs.

(3) When disconnecting front reach rod, rear reach rod, or drag link from idler arm, remove cotter pin and loosen idler shaft nut and carefully slide idler arm away from truck frame until necessary clearance for removal is obtained (fig. 2-356).

c. Reach Rod End Replacement (Fig. 2-357).

(1) Hold clamp bolt close to rod end and loosen clamp bolt nut. Unscrew rod end from rod sleeve.

(2) Screw new rod end into sleeve to dimensions (fig. 2-357).

(3) Make adjustment by turning rod end in or out of sleeve so that thread engagement at either end of sleeve does not exceed thread engagement of opposite end by more than two threads.

(4) Tighten clamp nut after steering alinement (para 2-196).

d. Installation.

(1) Place new seal on each rod end stud (fig. 2-357).

(2) After positioning rod end stud(s) on idler arm and before tightening stud nuts, seal idler arm on bracket and tighten nut to 170-200 lb-ft and secure with cotter pin.

(3) Position opposite end of rod in its respective position and secure each rod end stud with nut. Tighten nuts to 250-325 lb-ft and install cotter pins.

2-188. Tie Rod Replacement

Replacement procedures for number one and number two front axle tie rod assemblies are the same.

a. Removal.

(1) Remove cotter pin and nut from each end stud of rod to be removed.

(2) Using knock out adapter (11614133) as shown in figure 2-358, loosen rod end stud, remove adapter and disconnect rod. Using same procedure, loosen opposite end of rod and remove rod. Discard seal from both rod end studs.

b. Tie Rod End Replacement (Fig. 2-359).

(1) Loosen clamp bolt nut.

(2) Remove tie rod end from rod.

(3) Install new tie rod end. The distance between center of ball stud and rod end should be approximately 2 1/8 inches.

(4) Using above procedures install new rod end on opposite end of tie rod and tighten clamp bolt to 80-100 lb-ft.

c. Installation.

(1) Place new seal on each of the rod end studs (fig. 2-359).

(2) Position tie rod assembly on steering-knuckle arms and secure with nuts.

(3) Tighten nut on one rod end to 250-325 lb-ft and secure with cotter pin.

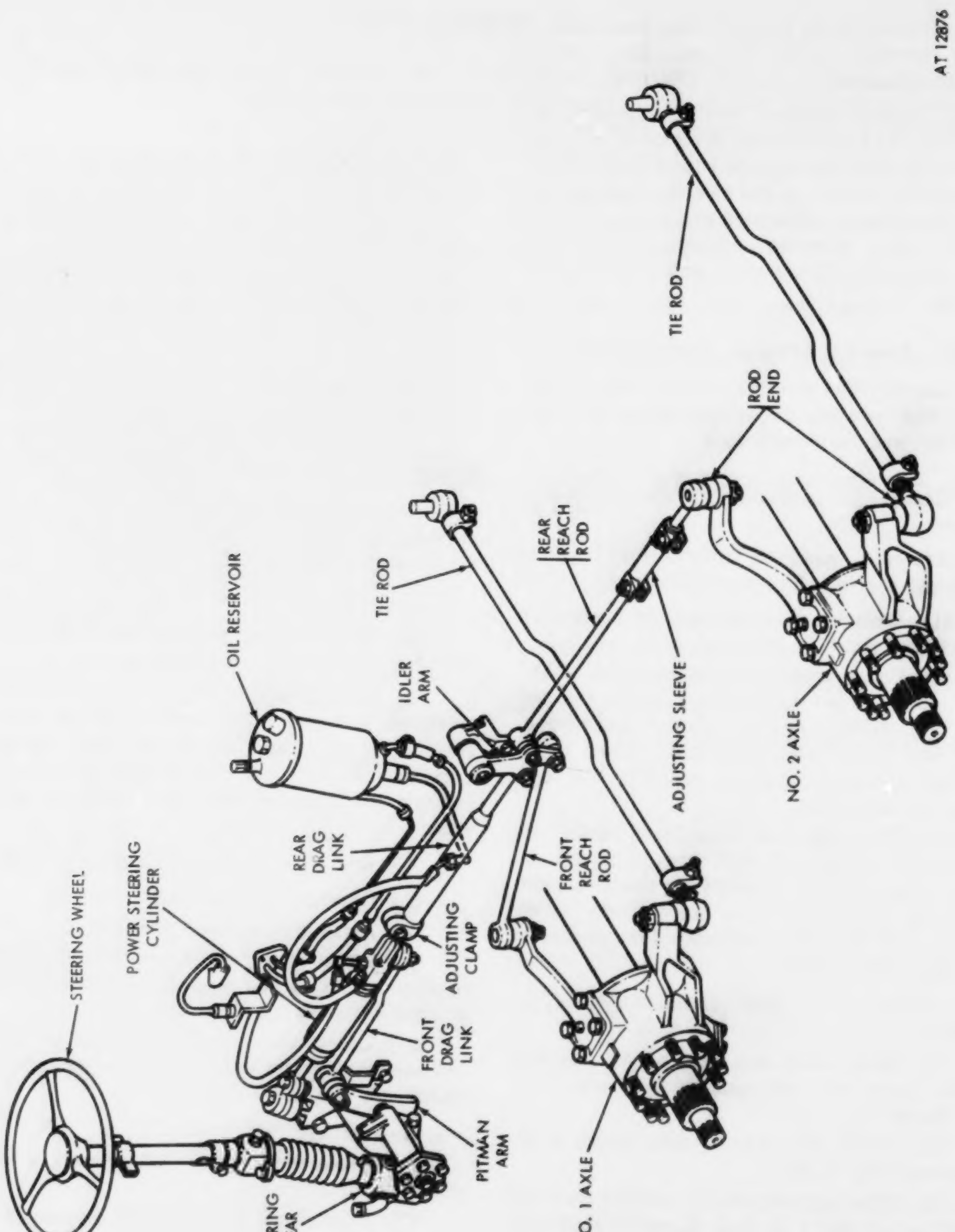

STEERING WHEEL
POWER STEERING CYLINDER
OIL RESERVOIR
REAR DRAG LINK
ADJUSTING CLAMP
FRONT DRAG LINK
PITMAN ARM
STEERING GEAR
NO. 1 AXLE
IDLER ARM
TIE ROD
FRONT REACH ROD
REAR REACH ROD
ADJUSTING SLEEVE
ROD END
TIE ROD
NO. 2 AXLE
AT 12876

Figure 2–353. Steering system diagram.

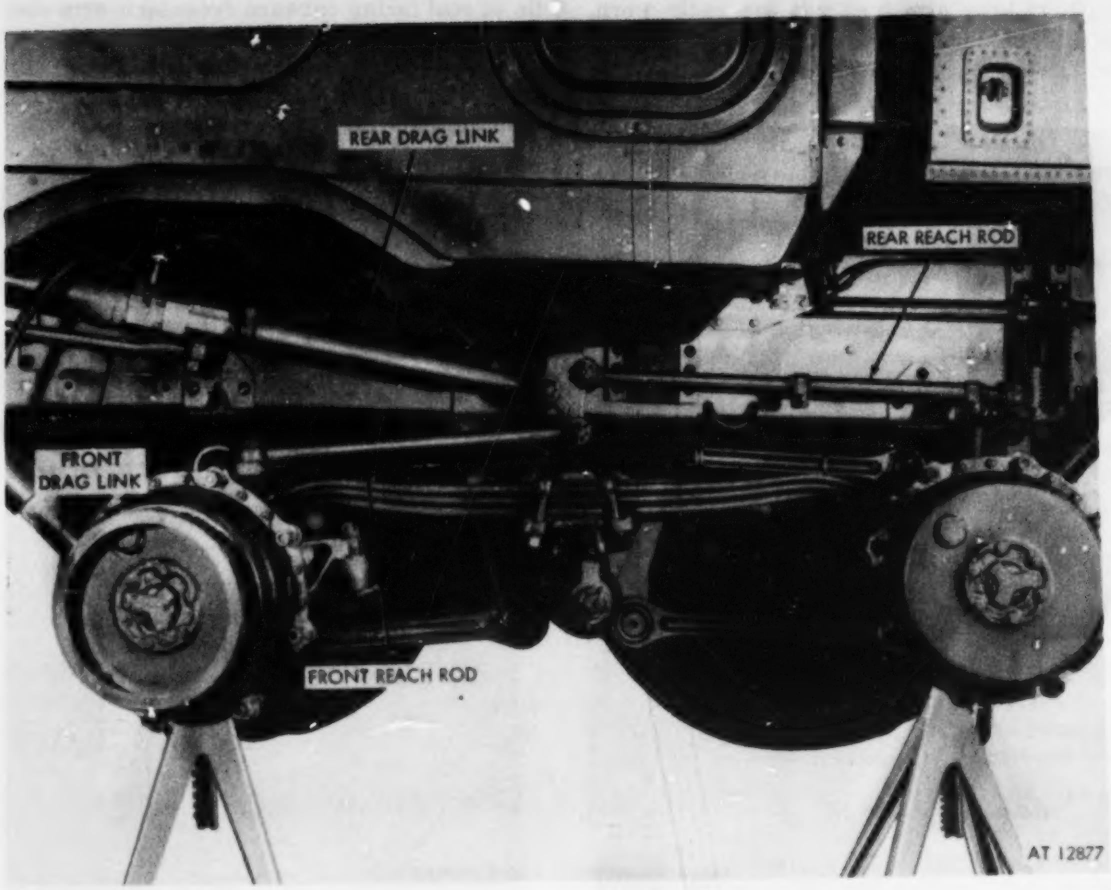


Figure 2–354. Steering linkage.

(4) Check toe-in of wheels. Refer to paragraph 2–196 and make necessary adjustment before securing opposite rod end stud. When proper toe-in is achieved, tighten stud nut to 250–325 lb-ft and secure with cotter pin.

(5) Recheck toe-in after tightening rod end.

2–189. Idler Arm (Fig. 2–360)

a. Removal. Before removing the idler arm, make sure that the front wheels are in straight-ahead position.

(1) Remove cotter pin and nut from front reach rod, rear reach rod and drag link at idler arm mounting.

(2) Using knock out adapter (11614133), and knock out bar (11614134), loosen rod end studs of all three above mentioned linkage rods.

(3) Remove cotter pin, nut and thrust washer securing idler arm to idler arm bracket.

(4) Slide idler arm outward from bracket and remove three linkage rods.

(5) Remove idler arm assembly from bracket shaft.

b. Seal Replacement.

(1) Remove seal from each end of idler arm.

(2) Thoroughly clean idler arm and idler shaft. If idler arm bushings are badly worn, cracked, or damaged, replace idler arm assembly.

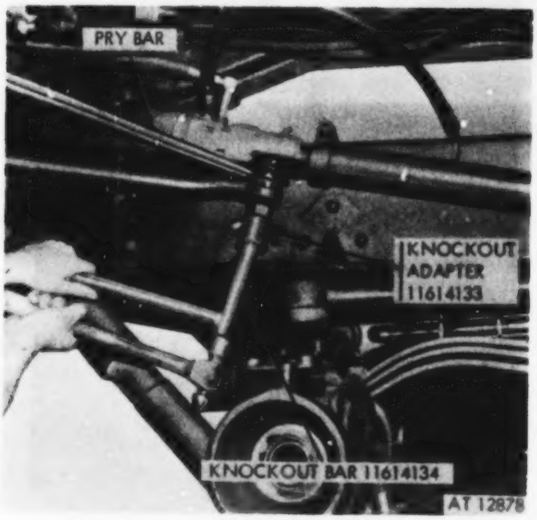

PRY BAR
KNOCKOUT ADAPTER 11614133
KNOCKOUT BAR 11614134
AT 12878

Figure 2-355. Using knockout adapter (11614133) and knockout bar (11614134) to loosen rod end stud.

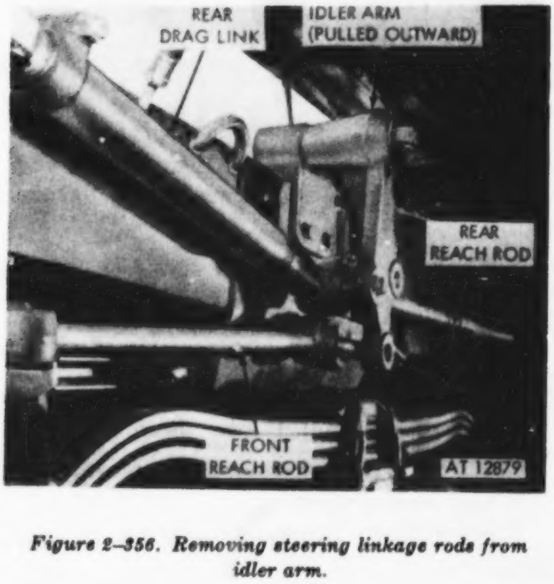

REAR DRAG LINK
IDLER ARM (PULLED OUTWARD)
REAR REACH ROD
FRONT REACH ROD
AT 12879

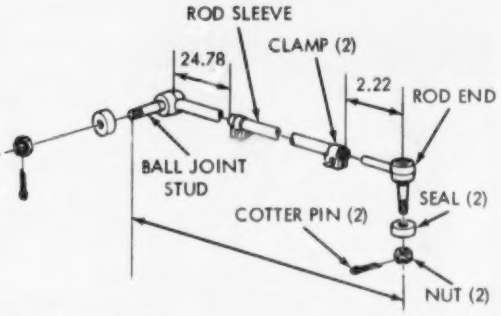
Figure 2-356. Removing steering linkage rods from idler arm.

(3) Position inner seal on idler arm with lip of seal facing outward from idler arm and, using replacer tool (11600903) and handle (7010321), secure seal in arm (fig. 2-361). Install outer seal in opposite end of arm using same procedures.

c. Installation.

(1) Using GAA type lubricant, lubricate seals, bearings and bracket shaft.

(2) Place inner thrust washer and idler arm on bracket shaft using care not to damage seals. Before seating arm on bracket position


ROD SLEEVE
24.78
CLAMP (2)
2.22
ROD END
BALL JOINT STUD
SEAL (2)
COTTER PIN (2)
NUT (2)
AT 12880

NOTE: ALL DIMENSIONS SHOWN ARE IN INCHES.

Figure 2-357. Rear reach rod, exploded view.

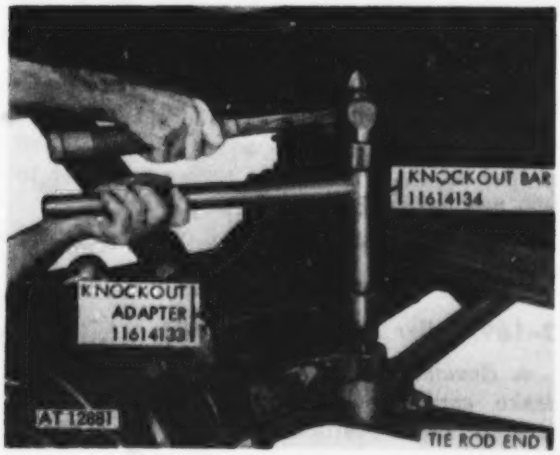

KNOCKOUT BAR 11614134
KNOCKOUT ADAPTER 11614133
AT 12881
TIE ROD END

Figure 2-358. Using knockout adapter (11614133) and knockout bar (11614134) to loosen tie rod end stud.

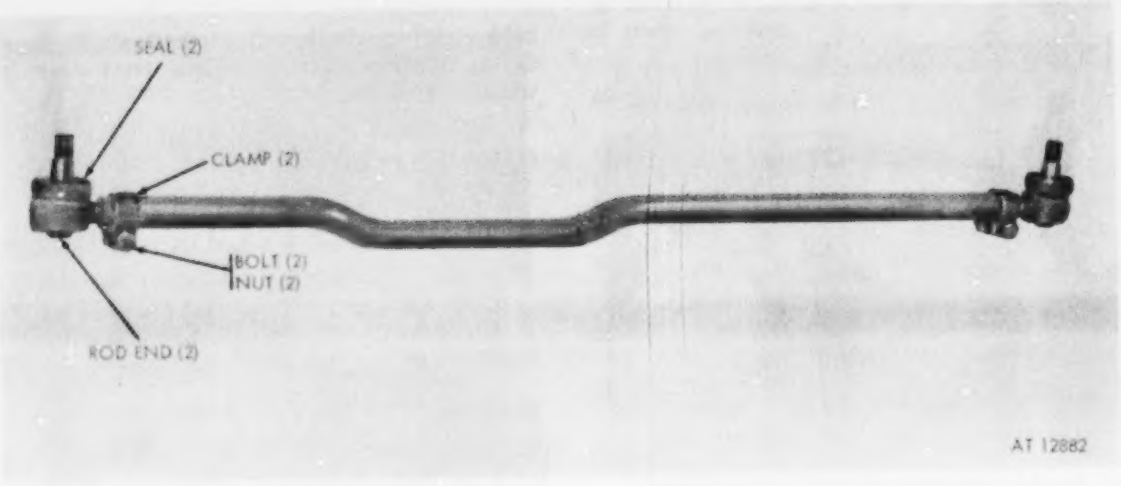

SEAL (2)
CLAMP (2)
BOLT (2)
NUT (2)
ROD END (2)
AT 12882

Figure 2-359. Tie rod assembly.

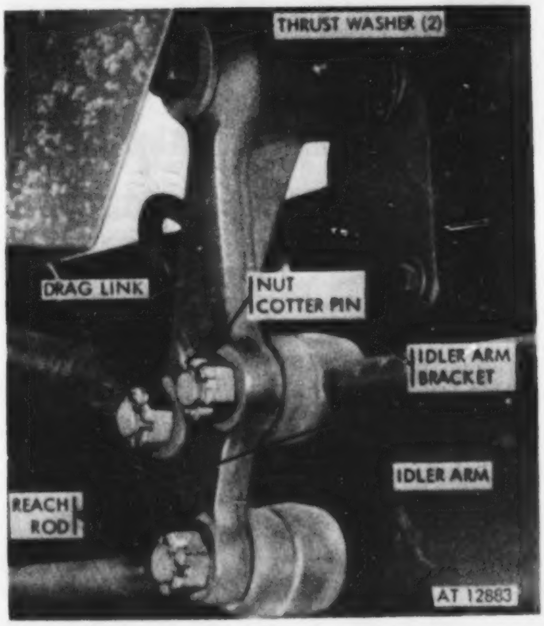

THRUST WASHER (2)
DRAG LINK
NUT
COTTER PIN
IDLER ARM
BRACKET
IDLER ARM
REACH
ROD
AT 12883

Figure 2-360. Idler arm and bracket.

drag link, front reach rod, and rear reach rod end studs in their respective mounting positions.

(3) Seat idler arm on bracket and position outer thrust washer and nut on shaft. Tighten nut to 170–200 lb-ft and secure with cotter pin.

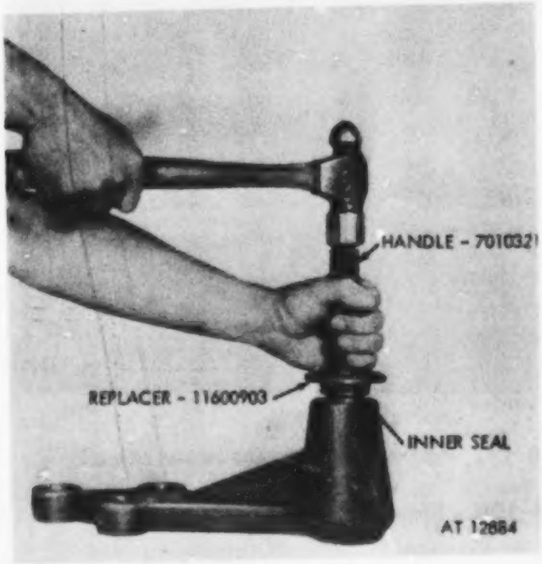

HANDLE - 701032
REPLACER - 11600903
INNER SEAL
AT 12884

Figure 2-361. Using replacer (11600903) and handle (7010321) to replace outer idler arm seal.

(4) Install nuts on front reach rod, rear reach rod and link rod end studs. Tighten nuts to 250–325 lb-ft and secure each nut with cotter pin (fig. 2–360).

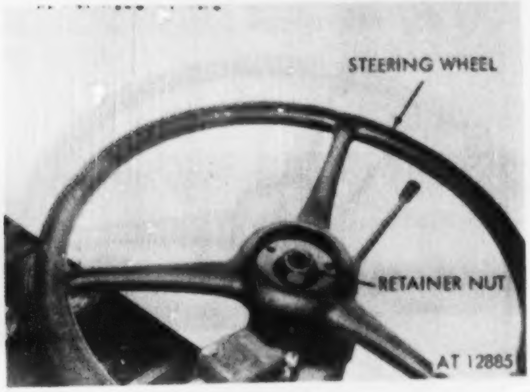

STEERING WHEEL
RETAINER NUT
AT 12885

Figure 2–362. Steering wheel and retainer nut.

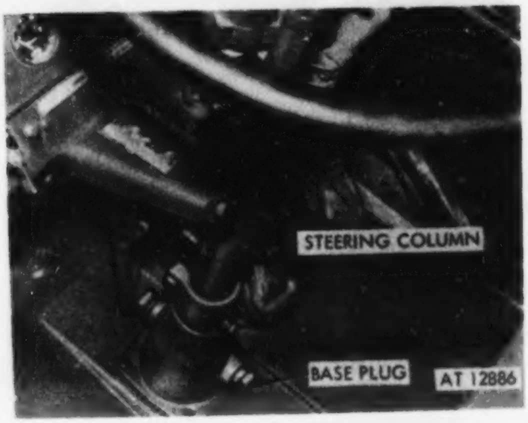

STEERING COLUMN
BASE PLUG
AT 12886

Figure 2–363. Steering column base.

2–190. Steering Wheel

a. Removal.

(1) Remove horn button cover and horn button (para 2–105).

(2) Remove contact cup, horn button spring and contact cap (para 2–105).

(3) Remove horn base plate assembly and grounding spring (para 2–105).

(4) Remove steering wheel retainer nut (fig. 2–362).

(5) Remove plug at base of steering column (fig. 2–363) and insert screwdriver to hold steering shaft and prevent shaft from falling down in steering column when steering wheel is removed.

(6) Remove steering wheel using puller (11600456) as shown in figure 2–364.

b. Installation.

(1) Place steering wheel on steering shaft

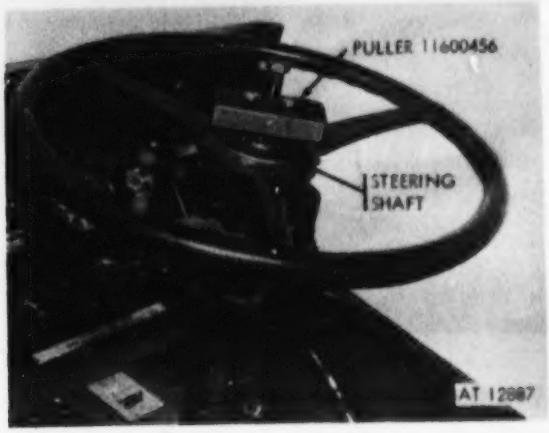

PULLER 11600456
STEERING SHAFT
AT 12887

Figure 2–364. Using puller to remove steering wheel.

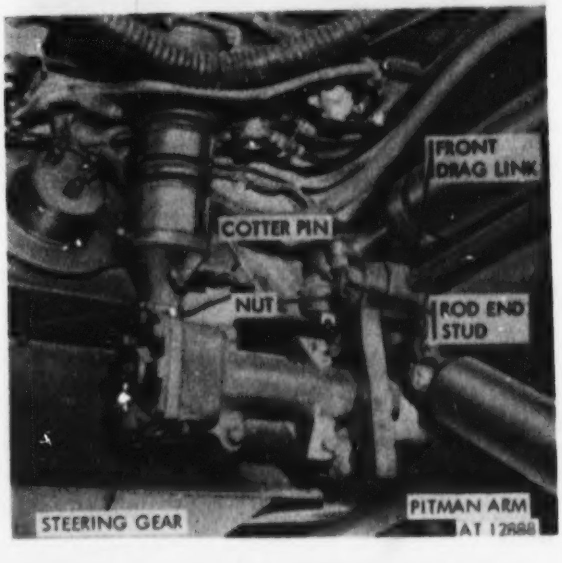

FRONT DRAG LINK
COTTER PIN
NUT
ROD END STUD
STEERING GEAR
PITMAN ARM
AT 12888

Figure 2–365. Steering gear pitman arm and front drag link.

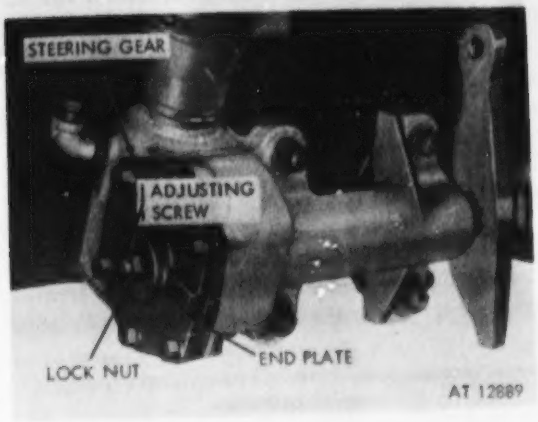


Figure 2-366. Steering gear housing assembly and adjusting screw.

and secure with nut (fig. 2-362). Tighten nut to 35-45 lb-ft and stake nut on steering shaft (one point) using center punch.

(2) Remove screwdriver from steering column and replace plug (fig. 2-363).

(3) Install grounding spring and horn base plate assembly (para 2-105).

(4) Install horn button and horn button cover (para 2-105).

2-191. Steering Gear

a. Worm Preload Adjustment (Gear in Vehicle).

(1) Remove cotter pin and nut securing drag link to steering gear pitman arm (fig. 2-365).

(2) Using knock out adapter (11614133) and knock out bar (11614134), loosen drag link rod end stud in pitman arm.

(3) Remove knock out adapter and disconnect drag link rod from pitman arm.

(4) Discard seal from rod end stud.

(5) Turn steering wheel to full right or left, and then turn back 3 1/8 turns, this will center steering gear.

(6) Loosen thrust adjusting screw lock nut (fig. 2-366). Turn screw as necessary until no backlash is present within 30° of each side of center position.

(7) Hold screw and tighten lock nut to 16-20 lb-ft.

(8) Place new seal on rod end stud.

(9) Place drag link rod end stud on pitman arm and install nut (fig. 2-365). Tighten nut to 250-325 lb-ft and secure with cotter pin.

b. Service. For service procedures of the steering gear refer to LO 9-2320-230-12.

2-192. Power Steering Fluid Replacement

Note. Key letters shown in parentheses refer to figure 2-367.

a. General. Any replacement of a component in the steering hydraulic system involves the draining of hydraulic oil and the subsequent refilling of the system with new hydraulic oil.

b. Draining the Hydraulic Steering System.

(1) Remove oil level gage (8).

(2) Remove power cylinder return hose (2) from power steering reservoir (1) and allow all hydraulic oil to drain into a suitable container.

(3) Disconnect one end only on hoses involved in the hydraulic system component replacement. Cap or plug all open lines, hoses, and fittings to prevent dirt or foreign material from entering the system.

c. Filling Hydraulic Steering System.

(1) Connect power cylinder hose (2) at reservoir (1).

(2) Fill reservoir with OE 10 to full level on oil level gage (8).

(3) Install and tighten oil level gage (8) in reservoir. Start and run engine at idle speed for several minutes.

(4) Place jacks under front bogie and lift vehicle weight from front wheels.

(5) Increase engine speed and turn steering wheel to the full right and full left position several times.

(6) Stop engine, check hydraulic reser-

voir oil level on gage and replenish as required. Check system for external leaks.

2-193. Power Cylinder and Control Valve Replacement

Note. Key letters shown in parentheses refer to figure 2-368.

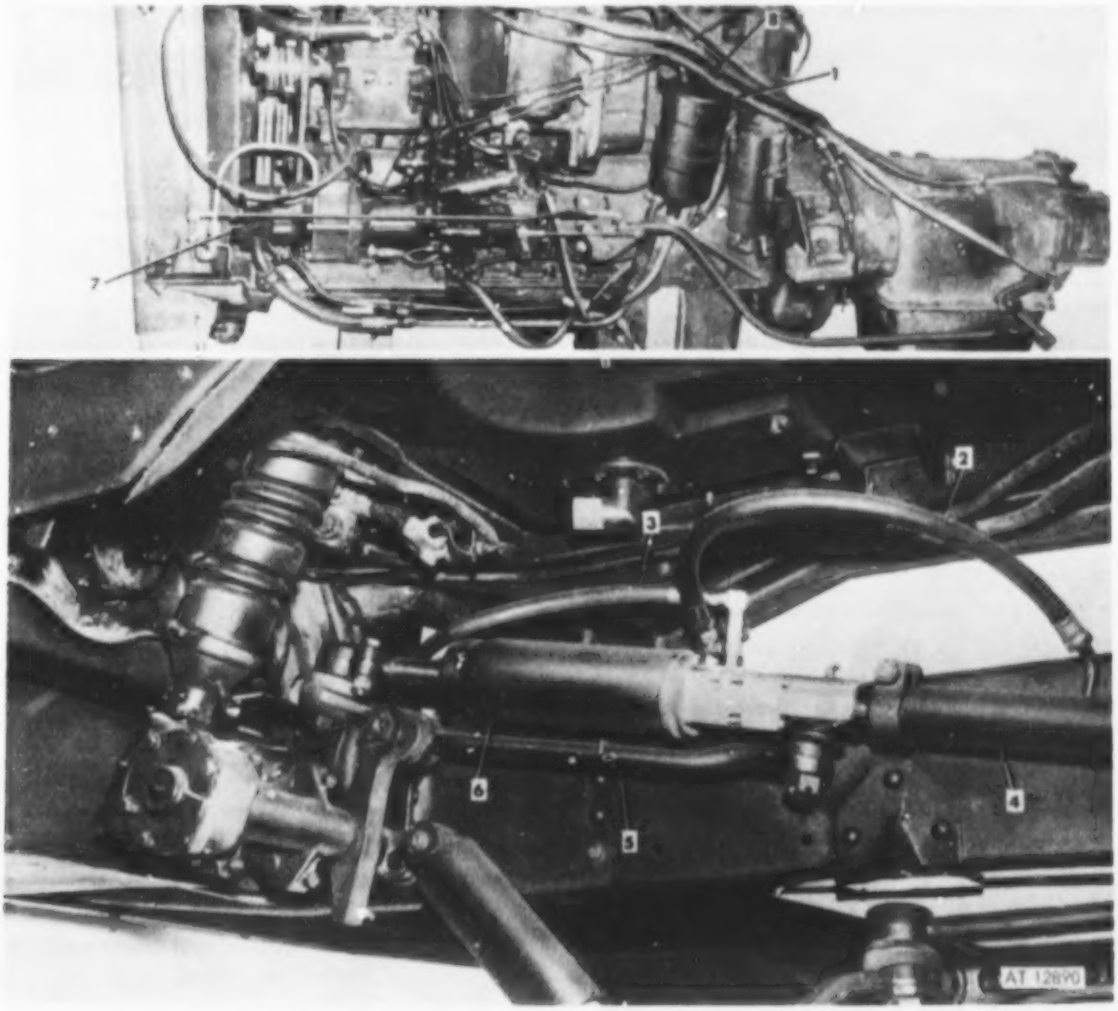
a. Removal.

(1) Drain power steering fluid as directed in paragraph 2-192.

(2) Disconnect inlet hose (3) and outlet hose (2) from power cylinder and remove fittings.

Note. Tag hoses to identify.

(3) Remove cylinder anchor ball stud as-

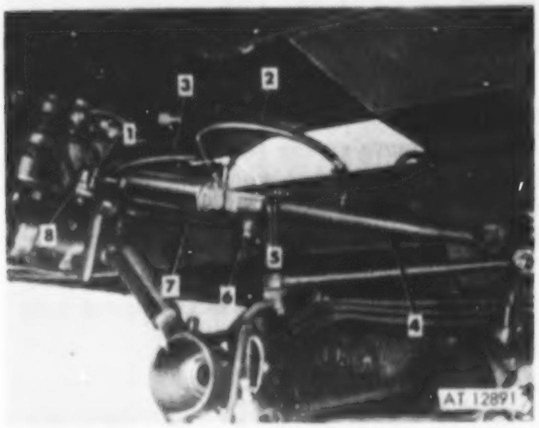


1—Reservoir
2—Power cylinder return hose
3—Power cylinder inlet hose
4—Rear drag link
5—Front drag link
6—Power cylinder
7—Power steering pump
8—Oil level gage

Figure 2-367. Hydraulic steering system components.

sembly (8), using knock out adapter (11614133) and knock out bar (11614134) through hole in front bumper.

(4) Remove front drag link (7) from power cylinder control ball stud (6) and rear drag link (4) from idler arm as directed in paragraph 2-189.



1—Clamp bolt
2—Outlet hose
3—Inlet hose
4—Rear drag link
5—Clamp bolt
6—Control ball stud
7—Front drag link
8—Ball end assembly.

Figure 2-368. Power steering cylinder, installed view.

(5) Loosen clamp bolt(s) and unscrew rear drag link (4) from power cylinder. Remove power cylinder and control valve assembly.

(6) Remove anchor ball stud from cylinder operating rod (fig. 2-369).

b. Installation.

(1) Install anchor ball stud on cylinder operating rod (fig. 2-369).

Note. **The distance between the ball end assembly and inboard end of flat surface of cylinder rod must be ½ inch.**

(2) Install rear drag link (4) at idler arm and front drag link (7) at power cylinder control ball stud (para 2-187*d*).

Note. **This distance from center of ball stud (on idler arm) to end face of cylinder (when valve and cylinder join) must be 33 5/16 inches.**

(3) Install anchor ball stud on pitman arm.

(4) Install fittings and power steering hoses (2 and 3) on power cylinder.

(5) Fill system with hydraulic fluid as directed in paragraph 2-192.

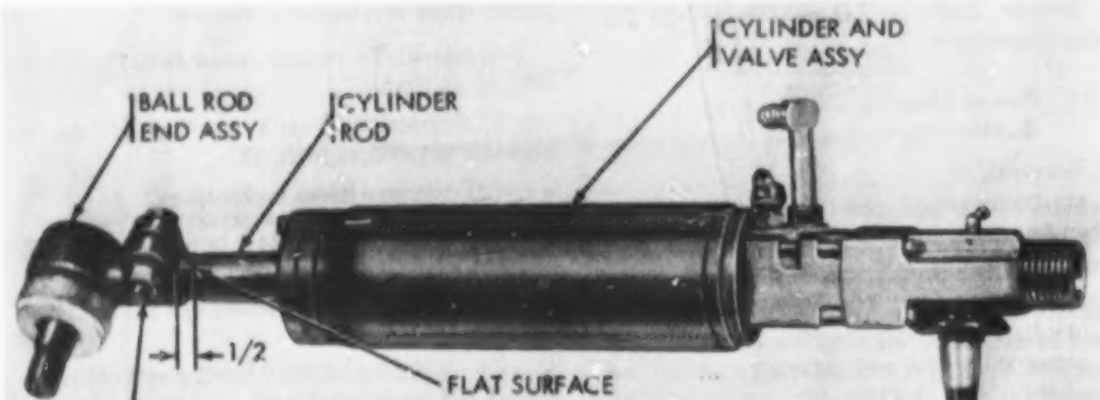


Figure 2-369. Power cylinder and control valve assembly.

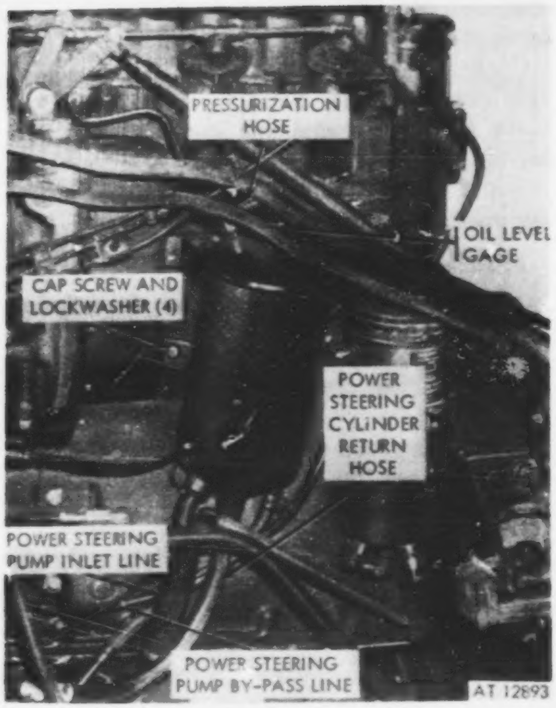

PRESSURIZATION HOSE
OIL LEVEL GAGE
CAP SCREW AND LOCKWASHER (4)
POWER STEERING CYLINDER RETURN HOSE
POWER STEERING PUMP INLET LINE
POWER STEERING PUMP BY-PASS LINE
AT 12893

Figure 2–370. Power steering reservoir and oil level gage.

(6) Adjust steering linkage as directed in paragraph 2–196.

c. Service. Refer to LO 9–2320–230–12 for service procedures.

2–194. Power Steering Oil Reservoir Replacement

a. Removal.

(1) Drain steering hydraulic system as described in paragraph 2–192*b*.

(2) Remove pressurization hose at connector on reservoir cover (fig. 2–370).

(3) Remove power steering pump by-pass line, pump inlet line, and steering cylinder return hose from bottom or reservoir (fig. 2–370).

(4) Remove four capscrews and lockwashers securing reservoir to engine and remove reservoir (fig. 2–370).

b. Service. Replacement of power steering reservoir filter element and gasket is recommended at regular 12,000 mile vehicle maintenance and when replacing the power steering cylinder or components. Refer to figure 2–371 and replace reservoir filter and gasket using repair kit 5702761, as follows:

(1) Remove oil level gage (1) and gasket (10). Discard gasket.

(2) Remove adapter (9) and gasket (2). Discard gasket.

(3) Remove cover (3) and gasket (7). Discard gasket.

(4) Remove spring (8), strainer (4), and element (5). Discard element.

(5) Clean all parts in dry-cleaning solvent or mineral spirits paint thinner.

(6) Reassemble reservoir in reverse order of disassembly using new parts supplied with kit.

c. Installation.

(1) Refer to removal procedures and reverse the sequence of instructions.

(2) Refill steering hydraulic system as directed in paragraph 2–192*c*.

2–195. Power Steering Hoses and Fittings Replacement

a. General. Fittings and hoses must be replaced when cracked or damaged.

b. Removal. To replace hoses or fittings, proceed as follows:

(1) Drain hydraulic steering system as directed in paragraph 2–192*b*.

(2) Remove hoses and fittings.

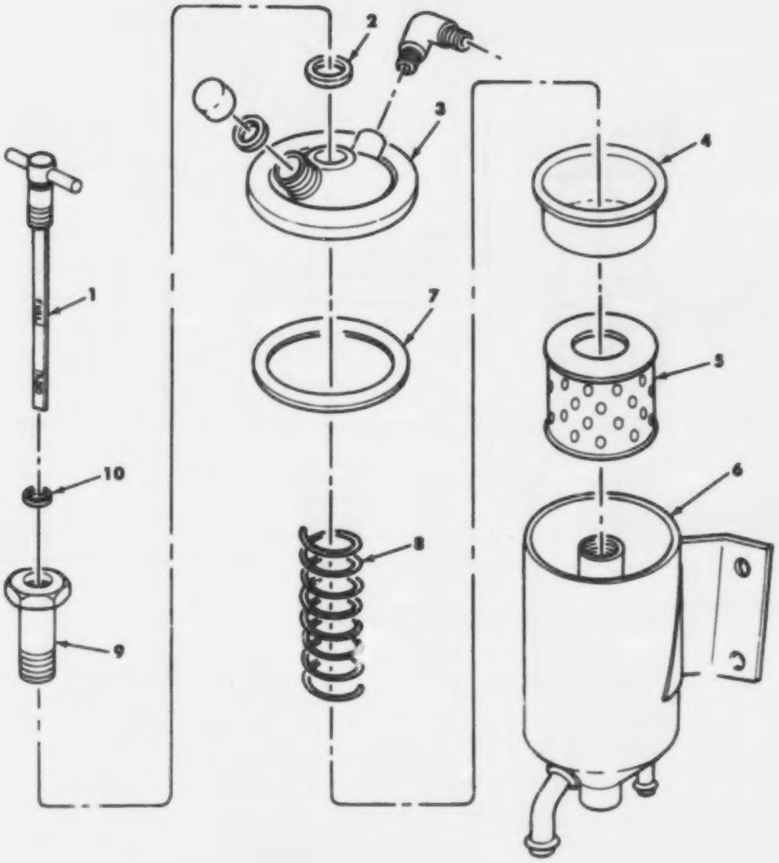
c. Installation. To install hoses and fittings, proceed as follows:

(1) Install hoses and fittings in their proper locations.

(2) Refill hydraulic steering system as directed in paragraph 2–192*c*.

2–196. Steering Alinement

To obtain proper steering alinement, the following checks and adjustments must be made in the order that they appear below.



1—Oil level gage
2—Gasket
3—Cover

4—Strainer
5—Filter element
6—Housing
7—Gasket

8—Spring
9—Adapter
10—Gasket

Figure 2–371. Removing and installing power steering reservoir filter kit.

a. Toe-In Adjustment. The toe-in adjustment procedures for No. 1 and No. 2 axles are identical and both axles should be adjusted consecutively. Refer to figure 2–372 and proceed as follows:

(1) Place floor jack under axle housing and raise front (No. 1) axle until wheels are off the ground.

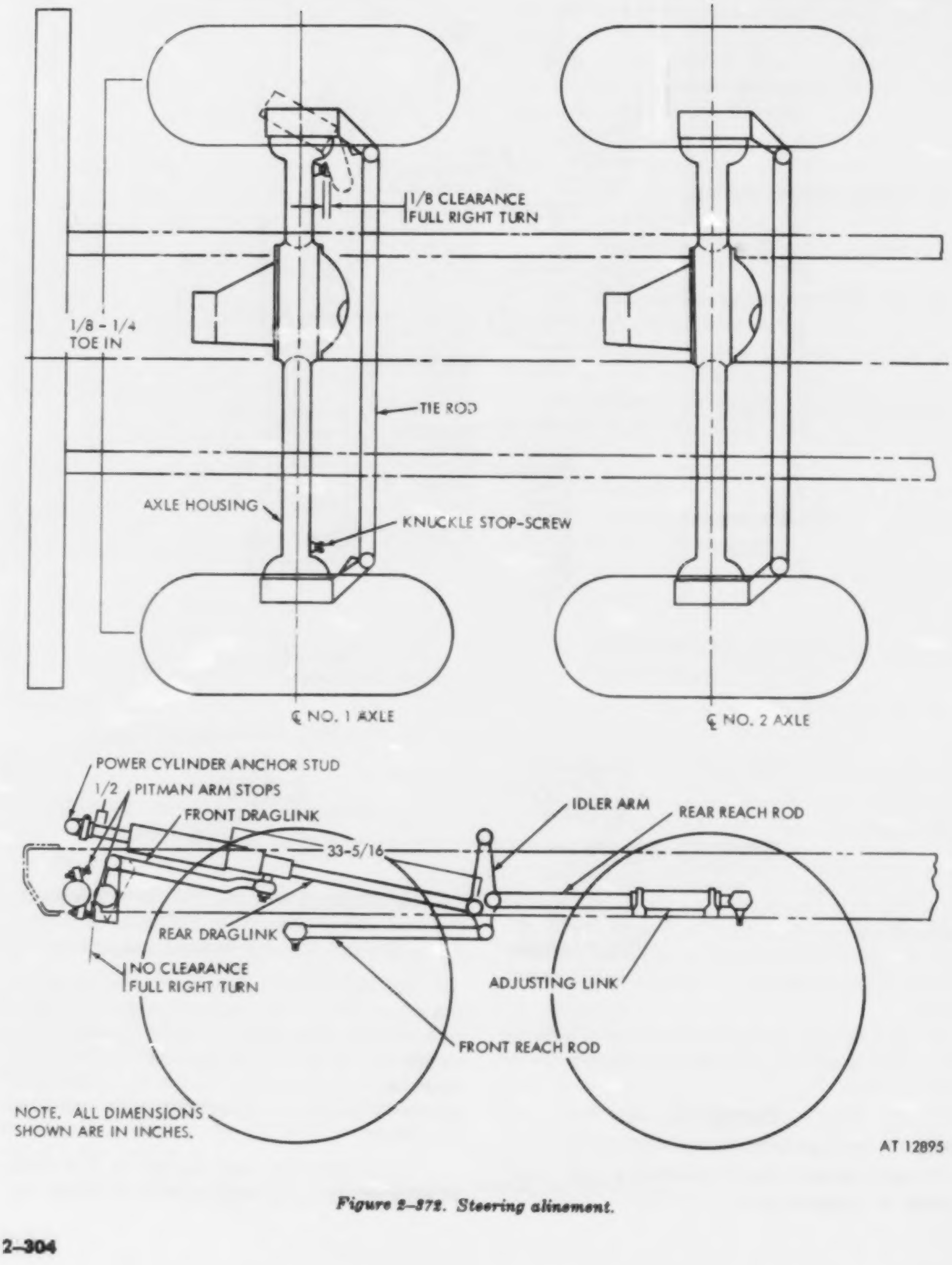
(2) While rotating tire one full turn, scribe a mark on the center of tire tread.

(3) Repeat above procedure and mark tread of opposite tire.

(4) Measure between the scribe marks on the rear side of the axle at height of the center line of the axle housing. Record measurement.

(5) Measure between the scribe marks on the front side of the axle at height of center line of the axle housing. This measurement should be 1/8 to 1/4-inch less than the measurement taken in operation (4) above. If this measurement is not correct proceed with operation (6) below.

(6) Disconnect one end of tie rod from steering knuckle. Loosen tie rod end clamp nut.


1/8 CLEARANCE
FULL RIGHT TURN
1/8 - 1/4
TOE IN
TIE ROD
AXLE HOUSING
KNUCKLE STOP-SCREW
℄ NO. 1 AXLE
℄ NO. 2 AXLE
POWER CYLINDER ANCHOR STUD
1/2
PITMAN ARM STOPS
FRONT DRAGLINK
IDLER ARM
REAR REACH ROD
33-5/16
REAR DRAGLINK
NO CLEARANCE
FULL RIGHT TURN
ADJUSTING LINK
FRONT REACH ROD
AT 12895

NOTE. ALL DIMENSIONS SHOWN ARE IN INCHES.

Figure 2-372. Steering alinement.

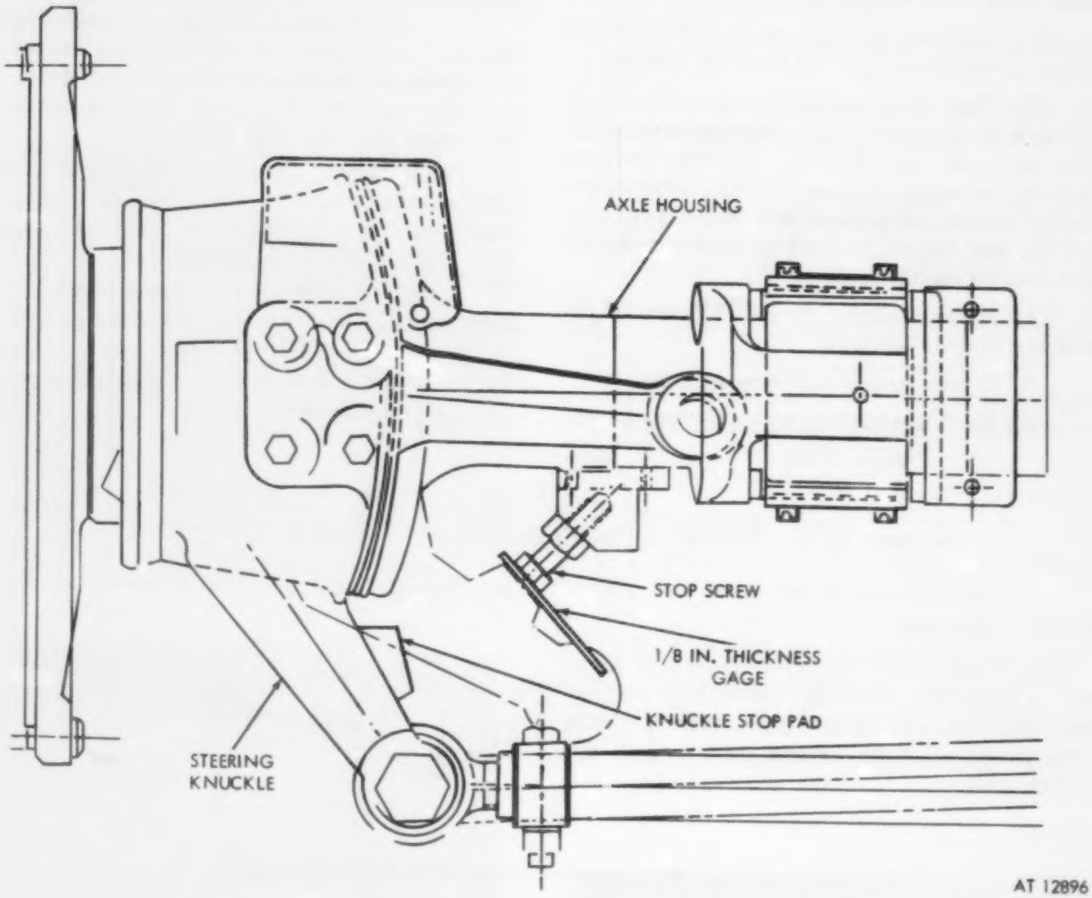


Figure 2-373. Left wheel stop screw and steering knuckle stop pad.

If difference in measurement obtained in operation (5) above is less than ⅛ inch, turn tie rod end out (counterclockwise when viewed from the right side of the truck). If the difference is more than ¼ inch, turn the tie rod end in (clockwise). When proper adjustment has been achieved, connect the tie rod to steering knuckle and tighten clamp.

Note. Each revolution of the tie rod end will change the toe-in adjustment (measurement) by approximately ⅛ inch.

(7) Repeat operations above to check toe-in on No. 2 axle.

b. Wheel Alinement. Refer to figure 2-372 and proceed as follows:

(1) Place floor jacks under front bogie and raise vehicle until front wheels are off ground.

(2) Visually position the No. 1 axle wheels in a straight-ahead position.

(3) Adjust the rear drag link (para 2-193*b*).

(4) Using the adjusting link in the rear reach rod, aline the wheels on No 2 axle straight ahead. With a straight-edge (100 inches long) adjust the wheels on axles No. 1 and No. 2 to a parallel condition (fig. 2-372).

c. Steering Stop Adjustment. Refer to figure 2-373 and proceed as follows:

(1) Place floor jack under front bogie and raise axles until wheels are off ground.

(2) Start engine and run at idle speed to obtain power assistance in turning wheels.

(3) Turn steering wheel to the left until a 1/8-inch thick gage is tight between stop screw and stop pad on steering knuckle. Release steering wheel to remove tension on linkage. Loosen locknut on pitman arm stop screw (fig. 2-372) and adjust to zero clearance between stop screw and pitman arm.

(4) Repeat above operations for right steering stop adjustment.

(5) Lower vehicle and remove jacks.

(6) Road test and recheck steering stops.

d. Tracking Adjustment. Refer to figure 2-372 and proceed as follows:

(1) Drive vehicle straight ahead. If the steering road wheels are not tracking properly, the wheels on No. 2 axle assembly will move to the right or left. To adjust tracking proceed with steps (2), (3), and (4).

(2) If No. 2 axle wheels are moving to the left, lengthen the rear reach rod by loosening clamp nuts and turning adjusting link clockwise (viewed from rear of vehicle).

(3) If No. 2 axle wheels are moving to the right, shorten the rear reach rod by loosening clamp nuts and turning adjusting link counterclockwise (viewed from rear of vehicle).

(4) Road test and recheck tracking.

Section XXXI. FRAME, TOWING ATTACHMENTS, AND DRAWBARS

2-197. General

This chapter includes procedures for removal, installation, cleaning, inspection and repair, for the rear bumperettes, towing pintle, fifth wheel platform ramps, fifth wheel, and lifting eyes.

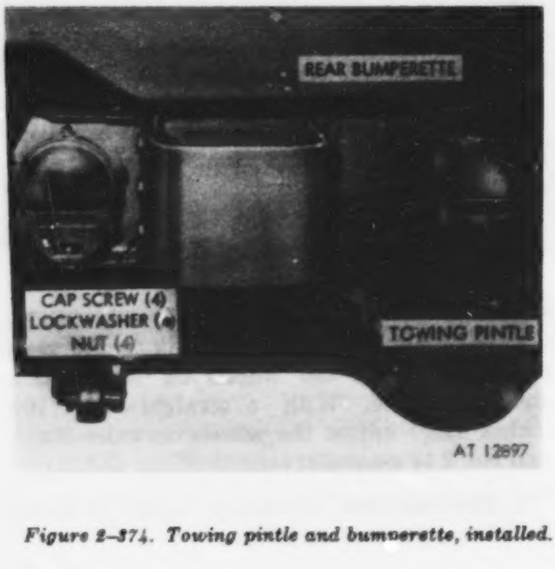


Figure 2-374. Towing pintle and bumperette, installed.

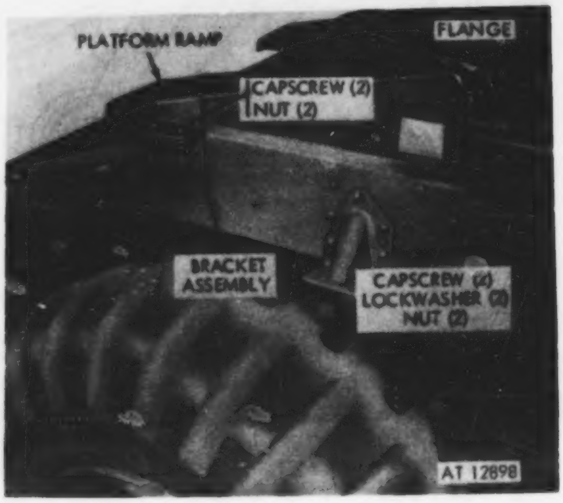


Figure 2-375. Fifth wheel platform ramp.

2-198. Rear Bumperette, M656, XM791 (Fig. 2-374)

a. Removal.

(1) Remove four capscrews, lockwashers and nuts retaining bumperette to frame.

(2) Remove bumperette.

b. Installation. Refer to removal procedure and reverse sequence of instructions.

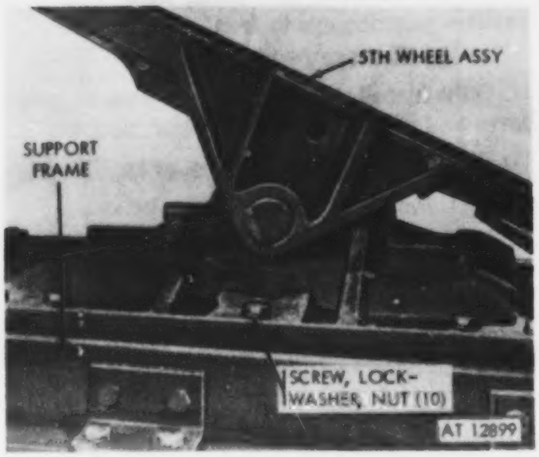

5TH WHEEL ASSY
SUPPORT FRAME
SCREW, LOCK-WASHER, NUT (10)
AT 12899

Figure 2-376. Fifth wheel assembly.

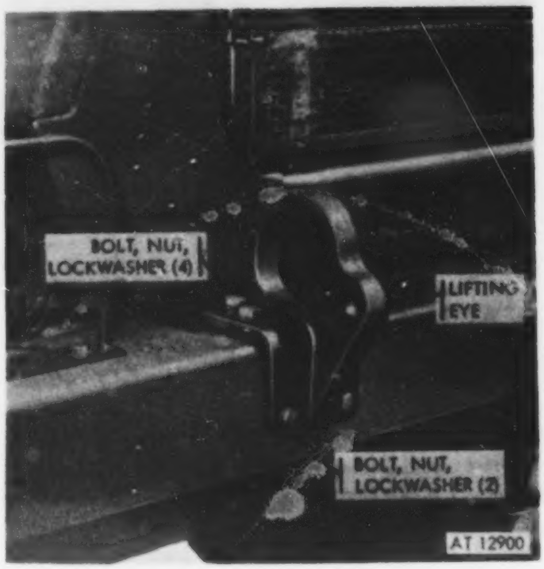

BOLT, NUT, LOCKWASHER (4)
LIFTING EYE
BOLT, NUT, LOCKWASHER (2)
AT 12900

Figure 2-377. Lifting eye, front.

2-199. Towing Pintle

a. Removal (Fig. 2-374).

(1) Remove lubrication fitting in frame rail bracket.

(2) Remove cotter pin, nut and flat washer retaining pintle to frame, remove pintle.

(3) Remove two lubrication fittings from pintle hook.

b. Cleaning, Inspection and Repair.

(1) *Cleaning.* Clean all parts of pintle assembly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts thoroughly.

(2) *Inspection.* Inspect all surfaces of pintle assembly for wear; inspect threaded parts for burred or damaged threads.

(3) *Repair.* If any parts are found to be excessively worn, replace pintle.

c. Installation. Refer to removal procedures and reverse sequence of instructions.

2-200. Fifth Wheel Platform Ramps (XM757 Only)

a. Removal (Fig. 2-375).

(1) Remove two capscrews and locknuts retaining platform ramp to bracket assembly.

(2) Remove two capscrews, lockwashers

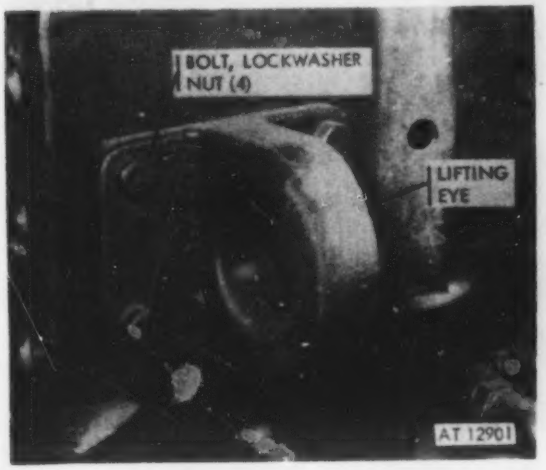

BOLT, LOCKWASHER NUT (4)
LIFTING EYE
AT 12901

Figure 2-378. Lifting eye, rear.

and nuts attaching platform ramp flange to fifth wheel assembly support frame.

(3) Repeat procedures (1) and (2) for other platform ramp.

b. Installation. Refer to removal procedures and reverse sequence of instructions.

2-201. Fifth Wheel (XM757 Only)

a. Removal (Fig. 2-376).

(1) Remove 10 screws, lockwashers and nuts holding fifth wheel assembly to support frame.

(2) Using a lifting device, remove fifth wheel assembly.

b. Installation. Refer to removal procedure and reverse sequence of instruction. Tighten retaining nuts to 131-146 lb-ft.

2-202. Lifting Eye (Front and Rear)

a. Lifting Eye, Front (Fig. 2-377).

(1) *Removal.*

(*a*) Remove four bolts, nuts, and lockwashers, securing lifting eye to top of bumper.

(*b*) Remove two bolts, nuts, and lockwashers securing eye to front of bumper.

(*c*) Remove front lifting eye.

(2) *Installation.* Refer to removal procedures and reverse sequence of instructions.

b. Lifting Eye, Rear (Fig. 2-378).

(1) *Removal.*

(*a*) Remove four bolts, nuts and lockwashers.

(*b*) Remove rear lifting eye.

(2) *Installation.* Refer to removal procedures and reverse sequence of instructions.

Section XXXII. SPRINGS AND SHOCK ABSORBERS

2-203. General

a. This section contains information on the removal and installation for the shock absorber, shock absorber bushings, springs (front and rear), spring wear pads, axle bump stops and torque rods.

b. Procedure for shock absorber removal is applied to front shock absorbers on 8 x 8, 5-ton truck, cargo M656; van, expansible, XM791; and to both front and rear shock absorbers on the truck, tractor XM757.

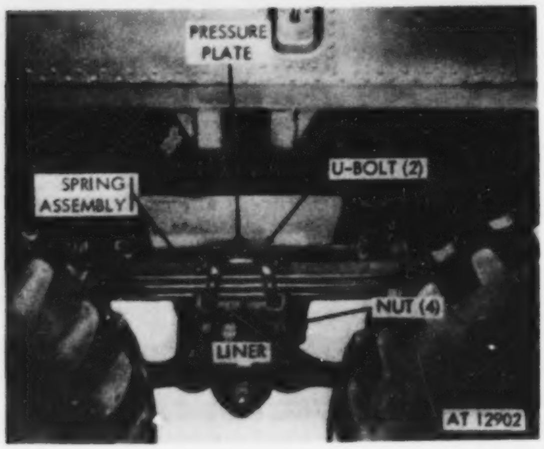


Figure 2-379. Spring, removal and installation.

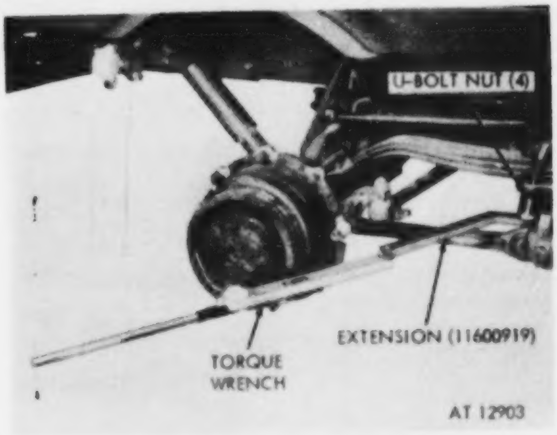


Figure 2-380. Using torque wrench extension (11600919) to tighten spring "U" bolt nuts.

2-204. Spring Replacement

a. Removal. Refer to figure 2-379 and proceed as follows:

(1) Position jack under bogie bracket and

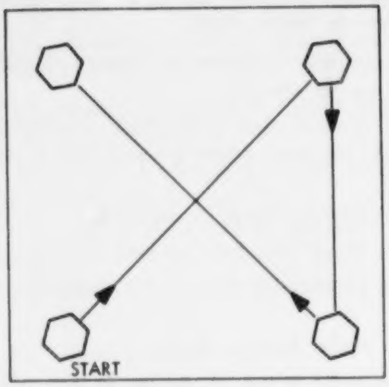


Figure 2–381. Spring "U" bolt nut tightening sequence.

raise vehicle until wheels are free of ground, and remove wheel and tire assemblies.

(2) Remove bump stops and spring pads as directed in paragraphs 2–205 and 2–206.

(3) Disconnect lower end of shock absorber, refer to paragraph 2–207.

(4) Remove upper torque rod end from rear axle.

(5) Remove "U" bolt nuts, "U" bolts, pressure plate and spring liner.

(6) Turn rear axle (No. 2 or No. 4 as applicable) down to provide maximum distance between axle assemblies.

(7) Slide spring assembly forward until rear leaf end clears axle housing, and remove spring assembly.

b. Installation. Refer to figure 2–379 and proceed as follows: Figure 2–379. Spring, removal and installation.

Note. This installation procedure will apply to all spring assemblies. Do not disassemble, and replace individual spring leaves.

(1) Refer to removal procedures and reverse sequence of instructions using new "U" bolts, nuts and liner.

(2) Tighten "U'" bolt nuts to proper torque value as directed in *c* below.

(3) Replace wheel and tire assembly and tighten wheel nuts to 250–270 lb-ft torque.

c. Spring "U" bolt tightening procedure.

Note. Spring "U" bolts must be tightened to 800–850 lb-ft torque at installation and within a minimum of 10 miles to a maximum of 100 miles of vehicle operation. Refer to figure 2–380 and proceed as follows:

(1) Place jack under bogie bracket, and raise vehicle until wheels are free of ground.

(2) Remove wheel and tire assemblies for wrench clearance.

(3) To obtain 800–850 lb-ft torque, use torque wrench (5120–221–7983) and special tool torque wrench extension (11600919) (fig. 2–380) and torque nuts to 550–567 lb-ft torque as follows:

(*a*) Tighten four nuts to initial torque of 20 lb-ft.

(*b*) Tighten nuts in four increments of 100 lb-ft using sequence as shown in figure 2–381.

(*c*) Tighten nuts a final increment of 140 lb-ft using sequence as shown in figure 2–381 to obtain the required 550–567 lb-ft.

Note. Torque values, when using torque wrench and extension, are values as indicated on the torque wrench.

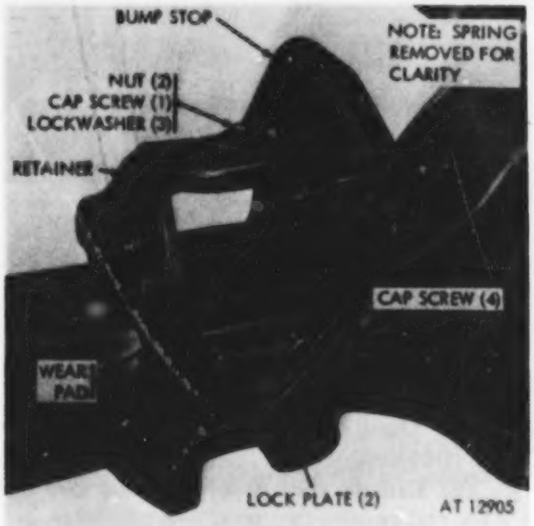


Figure 2–382. Spring wear pads and bump stops.

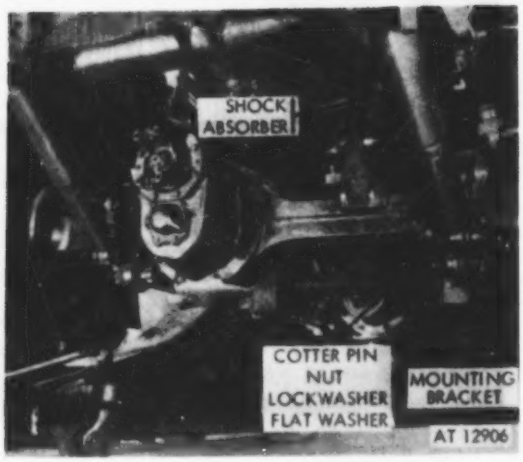


Figure 2-383. Shock absorber, installed.

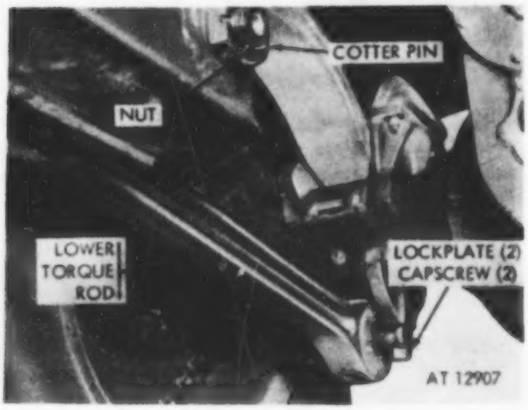


Figure 2-384. Torque rod lower.

2-205. Spring Wear Pads

a. Removal. Refer to figure 2-381 and proceed as follows:

(1) Place jack under bogie bracket and raise vehicle until ends of springs are free of wear pads.

(2) Remove four capscrews and two lock plates, and remove two wear pad retainers.

(3) Remove wear pad.

Note. This removal procedure will apply to all spring wear pads. Replace wear pads at spring replacement when inspection indicates pads to be worn beyond 3/16 inch minimum height limit.

b. Installation. Refer to figure 2-382 and proceed as follows:

(1) Install new wear pad. Position wear pad with thickest edge toward wheel end of axle.

(2) Tighten four capscrews.

(3) Bend over tabs on lock plate.

(4) Lower vehicle and remove jack.

2-206. Axle Bump Stops

a. Removal. Refer to figure 2-382 and proceed as follows:

(1) Remove two nuts, three lockwashers and one capscrew.

(2) Remove bump stop from wear pad retainer.

b. Installation. Refer to removal procedures and reverse sequence of instructions.

2-207. Shock Absorber and Bushings

a. Removal. Refer to figure 2-383 and proceed as follows:

(1) Remove cotter pin, nut, lockwasher and flat washer from each end of shock absorber mount and remove shock absorber.

(2) Remove shock absorber bushings from shock absorber eye.

b. Installation. Refer to removal procedures and reverse sequence of instructions.

Note. Tighten nuts to 90 lb-ft before installing cotter pins.

2-208. Torque Rod (Upper and Lower)

a. Lower Torque Rod Replacement.

Note. The replacement procedures given below apply to all lower torque rods.

(1) *Removal.* Refer to figure 2-384 and proceed as follows:

(*a*) Remove two capscrews and lock plates from torque rod mount at axle.

(*b*) Remove cotter pin and nut from torque rod end at bogie.

(*c*) Using remover (11600925) and hammer as shown in figure 2–385, loosen torque rod end.

(*d*) Remove remover from torque rod. Remove torque rod.

(2) *Installation.* Refer to figure 2–384 and proceed as follows:

(*a*) Position torque rod and install two lock plates and capscrews. Tighten capscrews to 320–415 lb-ft and secure by bending tabs of lock plates.

(*b*) Install nut and tighten to 250–275 lb–ft.

(*c*) Install cotter pin.

b. Upper Torque Rod Replacement.

Note. The replacement procedures given below apply to all upper torque rods.

(1) *Removal.* Refer to figure 2–385 and proceed as follows:

(*a*) Remove straps which secure air lines to torque rod.

(*b*) Remove two nuts and lockwashers retaining rod to bogie.

(*c*) Remove cotter pin and nut retaining rod to axle.

(*d*) Remove torque rod as directed in *a*(1)(*c*) and (*d*) above.

c. Installation. Refer to figure 2–385 and proceed as follows:

(1) Position torque rod and install two lockwashers and nuts. Tighten these nuts to 350–450 lb-ft.

(2) Install nut and tighten to 250–275 lb–ft.

(3) Install cotter pin.

(4) Install straps which secure air lines to torque rod.

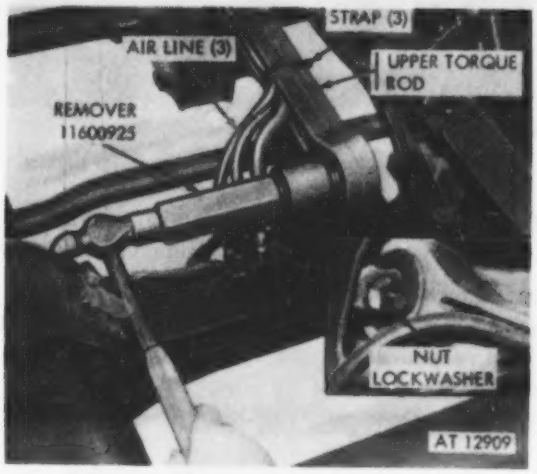


Figure 2–385. Removing upper torque rod.

Section XXXIII. CAB AND BODY

2–209. General

This section contains removal and installation procedures for cab components and accessories. Items included are: the radiator brush guard, door and window regulators and regulator handles, air lines and fittings, windshield and door glass, mounting insulators, seat cushions, stowage box, retaining straps, tailgate and sidegate seals and troop seat hinge spring.

2–210. Radiator Brush Guard

a. Removal. Refer to figure 2–386 and proceed as follows:

(1) Remove two bolts and flat washers from top of brush guard.

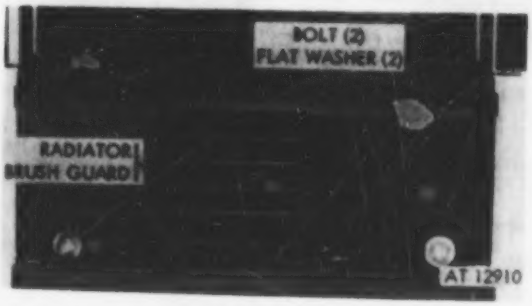


Figure 2–386. Radiator brush guard, removal and installation.

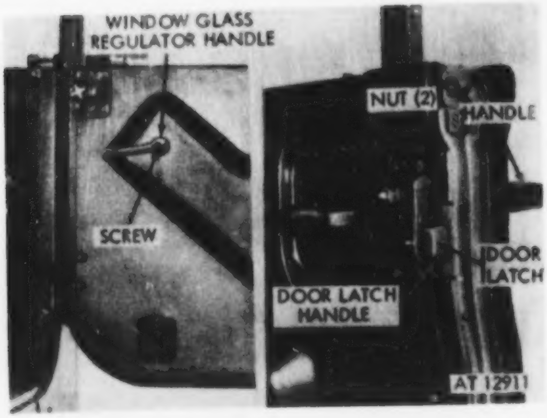

WINDOW GLASS REGULATOR HANDLE
NUT (2)
HANDLE
SCREW
DOOR LATCH
DOOR LATCH HANDLE
AT 12911

Figure 2-387. Door and window regulator handle.

(2) Tilt top of brush guard forward and lift up to clear dowels at bottom from holes in crossmember. Remove brush guard.

b. Installation. Refer to removal procedure and reverse sequence of instructions.

2-211. Door and Window Regulator Handles

a. Door Handles, Outer (Fig. 2-387).

(1) *Removal.* Remove cap nut and plain nut on door latch, remove handle.

Note. Removal of door inner handle is covered in paragraph 2-212.

(2) *Installation.* Refer to removal procedure and reverse sequence of instructions.

b. Window Glass Regulator Handle (Fig. 2-387).

(1) *Removal.* Remove screw, handle and spacer.

(2) *Installation.* Center spacer and handle over regulator assembly and fasten with screw.

2-212. Door Latch and Inner Panel (Fig. 2-388)

a. Door Latch.

(1) *Removal.*

(*a*) Remove cap nut and plain nut on door latch and remove handle (fig. 2-387).

(*b*) Remove four screws and remove latch assembly from door.

(2) *Installation.* Refer to removal procedure and reverse sequence of instructions.

b. Door Inner Panel.

(1) *Removal.*

(*a*) Remove door latch (*a* above).

(*b*) Remove screw and window operating handle (fig. 2-387).

(*c*) Remove two capscrews and lockwashers and remove door check strap.

(*d*) Remove 17 screws and remove door inner panel.

(2) *Installation.* Refer to removal procedure and reverse sequence of instructions.

2-213. Door Glass and Frame Assembly (Fig. 2-389)

a. Removal.

(1) Raise window to closed position.

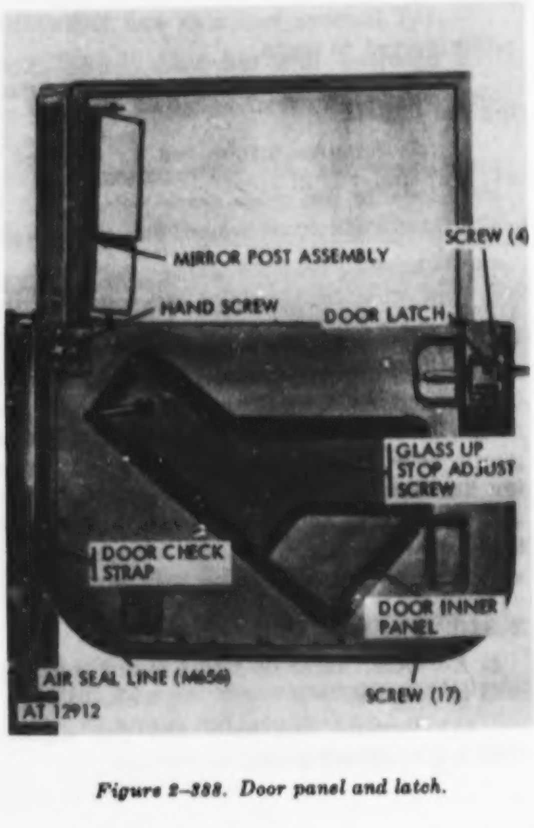

SCREW (4)
MIRROR POST ASSEMBLY
HAND SCREW
DOOR LATCH
GLASS UP STOP ADJUST SCREW
DOOR CHECK STRAP
DOOR INNER PANEL
AIR SEAL LINE (M656)
SCREW (17)
AT 12912

Figure 2-388. Door panel and latch.

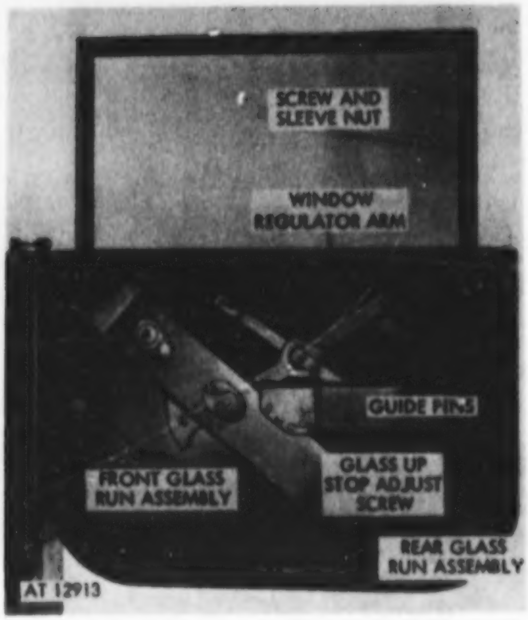

SCREW AND SLEEVE NUT
WINDOW REGULATOR ARM
GUIDE PINS
GLASS UP STOP ADJUST SCREW
FRONT GLASS RUN ASSEMBLY
REAR GLASS RUN ASSEMBLY
AT 12913

Figure 2–389. Door glass and regulator.

(2) Loosen hand screw and lift mirror post assembly out of socket in door (fig. 2–388).

(3) Remove latch and inner panel according to paragraph 2–212*a*.

(4) Remove snaprings from window regulator arm guide pins at lower window frame.

(5) Remove screw and sleeve nut on rear of window frame.

(6) Disengage regulator arms from window frame.

(7) Lift glass and frame assembly out of door.

b. Installation. Refer to removal procedure and reverse sequence of instructions, then refer to adjustment procedure in paragraph 2–216.

2–214. Door Glass Replacement

a. Removal.

(1) Remove door glass and frame assembly according to paragraph 2–213.

(2) Remove four screws at bottom of window frame.

(3) Remove frame and rubber gaskets from glass.

b. Installation. Refer to removal procedure and reverse sequence of instruction.

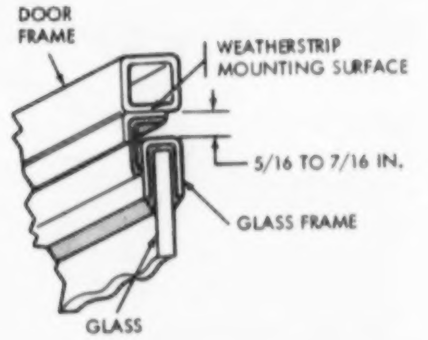
2–215. Window Regulator

a. Removal.

(1) Remove door glass and frame assembly according to paragraph 2–213.

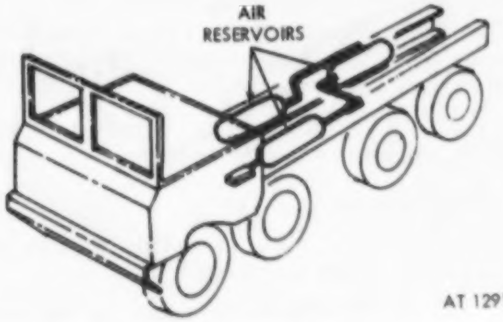
(2) Remove four screws and remove window regulator assembly.

b. Installation. Refer to removal procedure and reverse sequence of instruction, then refer to adjustment procedure in paragraph 2–216.


DOOR FRAME
WEATHERSTRIP MOUNTING SURFACE
5/16 TO 7/16 IN.
GLASS FRAME
GLASS

AT 12914

Figure 2–390. Weatherstrip mounting surface.


AIR RESERVOIRS

AT 12915

Figure 2–391. Air lines.

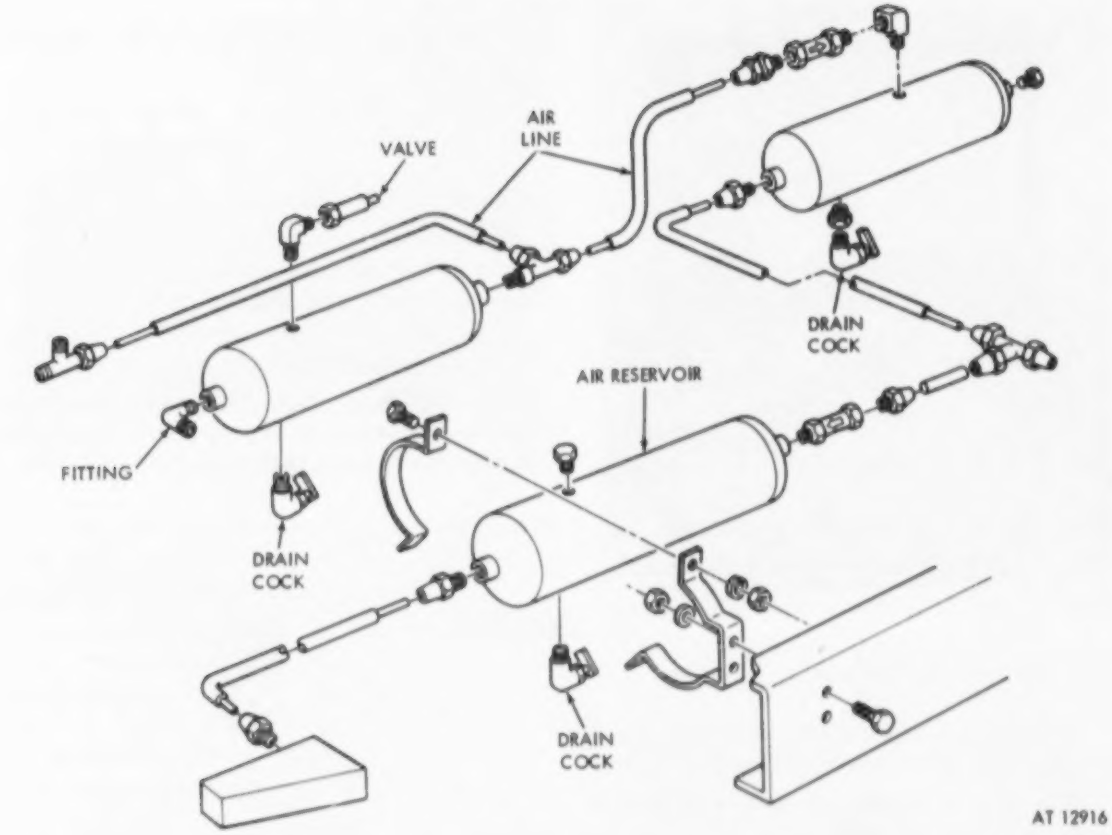


Figure 2-392. Air wire fittings.

2-216. Window Up-Stop Adjustment

a. Check Adjustment.

(1) Raise window to closed position.

(2) The measured gap between the top of glass frame and mounting surface of weatherstrip (fig. 2-390) should be 5/16 to 7/16 inch for correct adjustment.

(3) If measurement is according to (2) above, adjustment is not necessary.

b. Adjustment.

(1) Locate glass up-stop adjustment screw (figs. 2-388 and 2-389).

(2) If adjustment is made on driver's door with inner panel installed, remove four sheet metal screws and remove rear data plate on inner panel.

(3) Loosen glass up-stop adjustment screw.

(4) Raise window to correct position described in *a* above.

(5) Slide up-stop adjustment screw rearward until it stops.

(6) Tighten up-stop adjustment screw.

(7) Lower window and recheck adjustment according to *a* above.

2-217. Door Assembly

a. Removal.

(1) Remove two capscrews and lockwash-

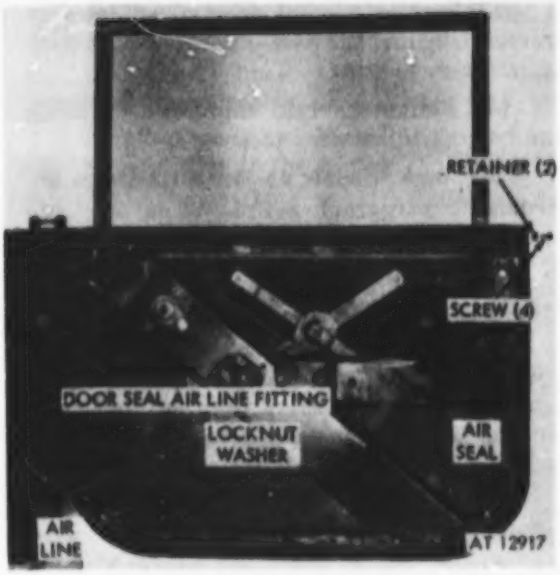

RETAINER (2)
SCREW (4)
DOOR SEAL AIR LINE FITTING
LOCKNUT
WASHER
AIR
SEAL
AIR
LINE
AT 12917

Figure 2-393. Door air seal.

ers on door and remove door check strap (fig. 2-388).

(2) Disconnect door air seal line (fig. 2-388).

(3) Remove eight capscrews and flat washers on door hinge and remove door.

b. Installation. Refer to removal procedures and reverse sequence of instruction, then refer to adjustment procedures in paragraph 2-218.

2-218. Door Hinge Adjustment

a. Check Adjustment.

(1) Holding door handle in unlatched position, metal parts should not rub when door is opened and closed.

(2) If metal parts rub, door adjustment is needed.

b. Adjustment.

(1) Loosen eight capscrews on door hinge.

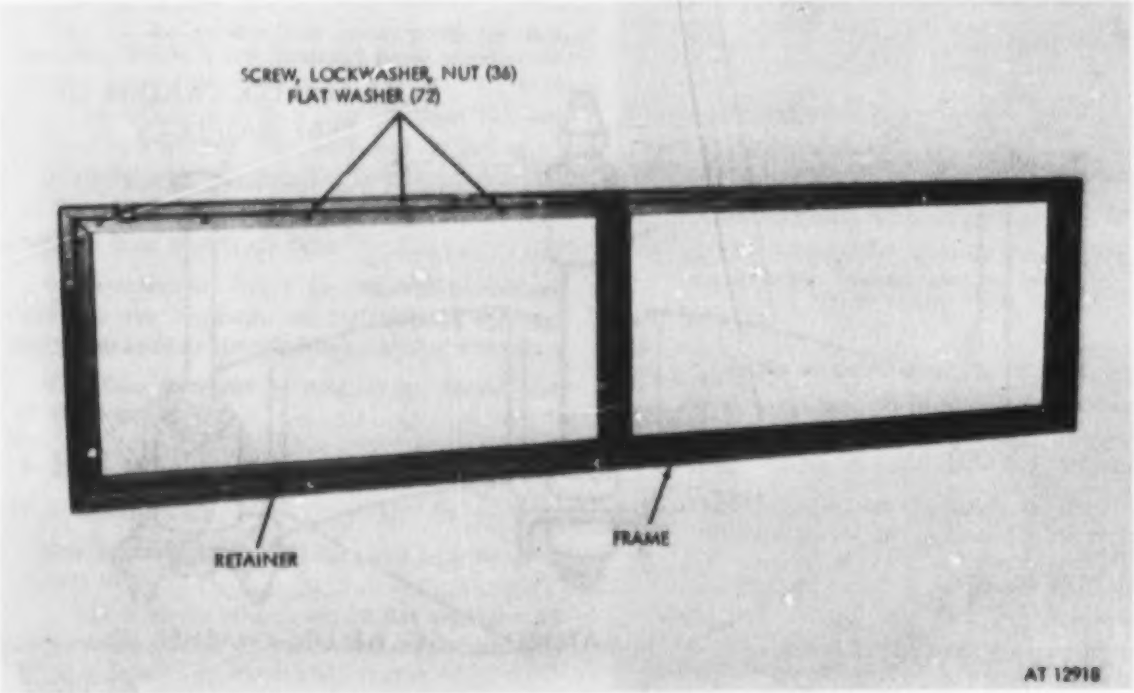

SCREW, LOCKWASHER, NUT (36)
FLAT WASHER (72)
RETAINER
FRAME
AT 12918

Figure 2-394. Windshield glass.

(2) Position door frontward or rearward so no metal parts are rubbing.

Note. Wiping action of door seals on door frame is permissible.

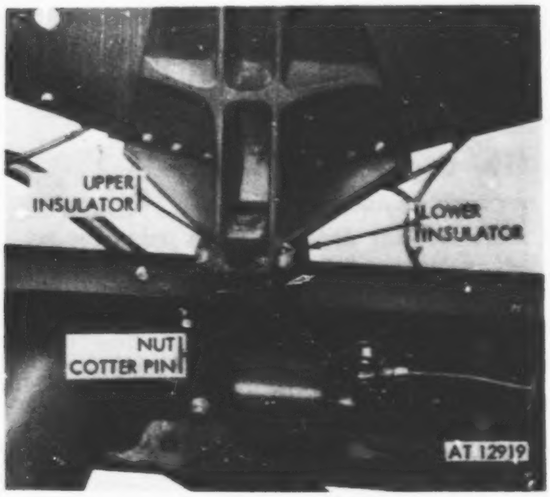

UPPER INSULATOR
LOWER INSULATOR
NUT
COTTER PIN
AT 12919

Figure 2-395. Front cab mounting insulator.

(3) Position rear of door up or down to prevent bending between guide pin and dove tail at rear of door.

(4) Retighten eight capscrews at hinge and recheck adjustment (*a* above).

(5) Check window up-stop adjustment according to paragraph 2-216*a* when door adjustment is complete.

2-219. Air Lines and Fittings (Figs. 2-391 and 2-392)

a. Removal. Open drain cocks and alternately release air pressure from left and right air reservoirs. Examine inlet and outlet fittings and lines. Remove only those lines and fittings necessary to accomplish replacement of defective lines, fittings, or valves.

b. Service. Basic service to air and brake systems require the use of a standard type tube cutter, wrenches, 0-200 psi air-pressure gage with adapter hose and fittings, and a soap solution with paint brush for air leak detection.

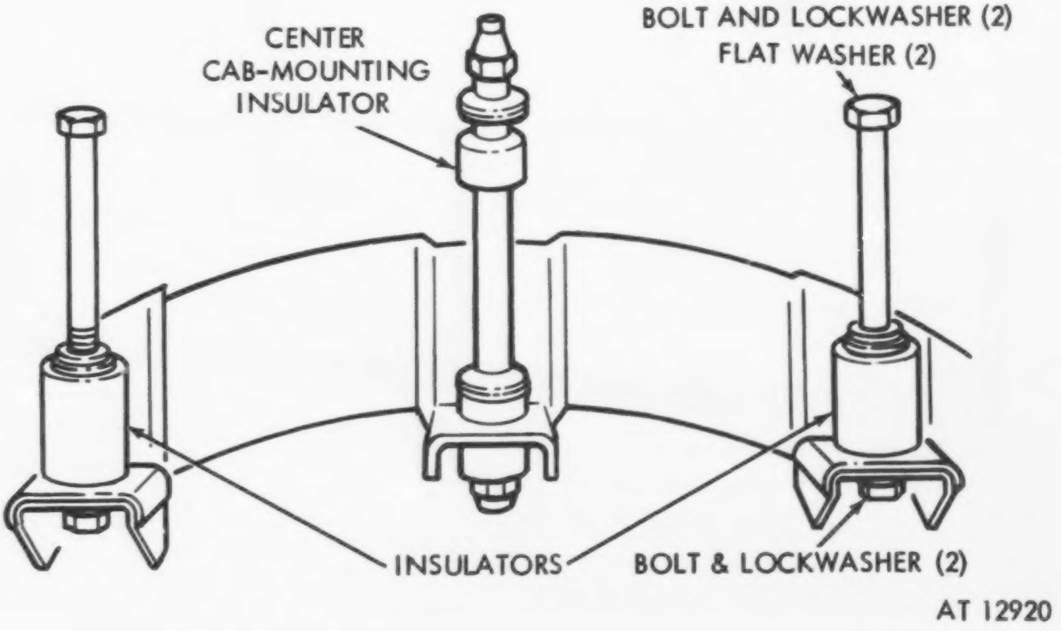

CENTER CAB-MOUNTING INSULATOR
BOLT AND LOCKWASHER (2)
FLAT WASHER (2)
INSULATORS
BOLT & LOCKWASHER (2)
AT 12920

Figure 2-396. Rear cab mounting insulators.

c. Installation. To install air lines, valves, or fittings, proceed as follows:

(1) Replace lines or fittings found damaged and unserviceable.

(2) Replace valves incapable of performing their function in the system.

(3) After making final installation, use test pressure gage as close to the valve or line being replaced. Check valves to meet air pressure specifications as directed in each of their respective replacement paragraphs.

(4) Tighten all fittings, start engine to build up air pressure. Observe vehicle air pressure gage on instrument panel. Air pressure should be at approximately 95–105 psi.

(5) Using soap solution and paint brush, apply solution to the fittings and lines which have just been installed. Observe lines and fitting for evidence of soap bubbles. Repair lines if necessary.

2–220. Door Air Seal (Fig. 2–393)

a. Removal.

Note. Do not remove door inner panel for this operation. Figure 2–393 illustrates panel removed for clarity of connections only.

(1) Disconnect door seal air line; remove locknut and washer from door seal air fitting.

(2) Remove two door seal retainer screws at front of door and screws at rear of door and remove door seal from door.

b. Installation. Refer to removal procedure and reverse sequence of instructions making sure seal is fully inserted in retaining groove.

Note. Door seals must be installed dry. Do not soak or use lubricant.

2–221. Windshield Glass (Fig. 2–394)

a. Disassembly.

Note. Do not remove windshield frame from vehicle to replace glass.

(1) Remove 36 screws, 72 flat washers, 36 lockwashers, and 36 nuts holding windshield glass retainers to windshield frame.

(2) Remove windshield retainers and seals from windshield glass.

b. Assembly. Refer to disassembly procedure and reverse sequence of instruction.

2–222. Cab Mounting Insulator (Front and Rear)

a. Front Cab-Mounting Insulator Removal. Refer to figure 2–395 and proceed as follows:

(1) Remove cotter pin, nut, and bolt from front insulator.

(2) Using a suitable lifting device, raise front of cab approximately one inch and remove two insulators and tubular spacer.

(3) Refer to steps (1) and (2) above and

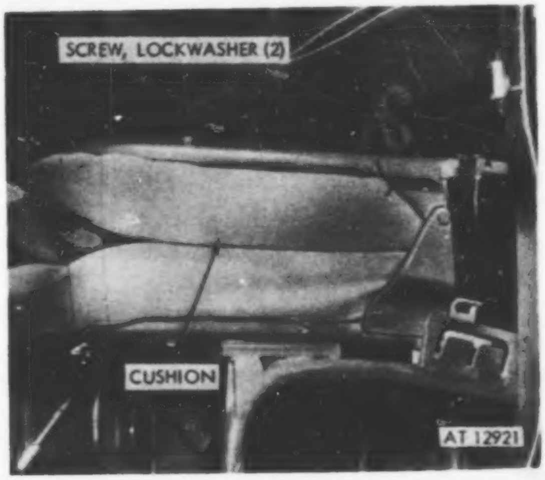


Figure 2–397. Cushion (seat and back).

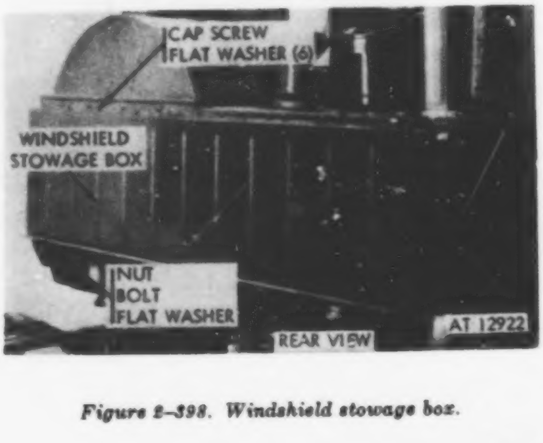


Figure 2–398. Windshield stowage box.

remove opposite front insulators in the same manner.

b. Installation. Refer to removal procedures and reverse sequence of instructions for both right and left front cab-mounting insulators.

c. Rear Cab-Mounting Insulator Removal. Refer to figure 2-396 and proceed as follows:

(1) Remove right-hand cab-mounting upper bolt, lockwasher and flat washer, remove lower bolt and lockwasher.

(2) Repeat procedure in step (1) above for left-hand cab-mounting insulator.

(3) Remove upper nut, retainer, and insulator from center mount.

(4) Remove lower nut, retainer, and insulator.

(5) Using a suitable lifting device, raise rear of cab approximately one inch and remove right and left insulators, center mount, retainer, and insulator.

(6) Remove windshield stowage box as directed in paragraph 2-224.

d. Installation. Refer to removal procedures and reverse sequence of instructions. Tighten nuts for front right and left cab-mounting insulators to 138 lb-ft and install cotter pin.

Note. **Advance nut if required to aline cotter pin holes, do not back off.**

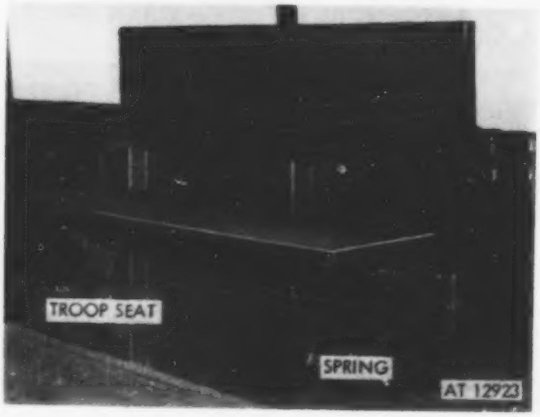


Figure 2-399. Troop seat locking spring.

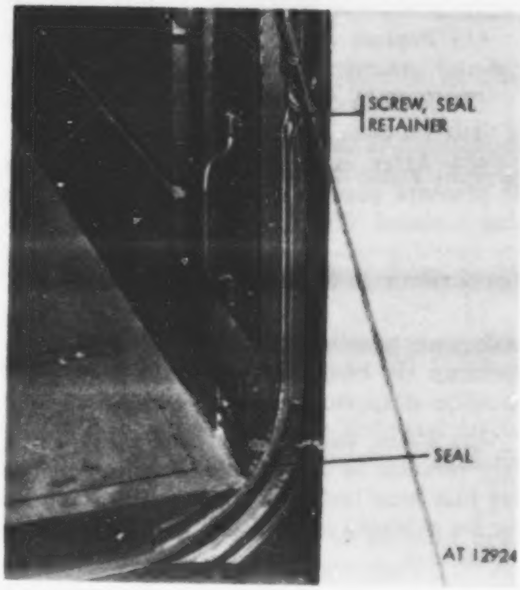


Figure 2-400. Tailgate seal.

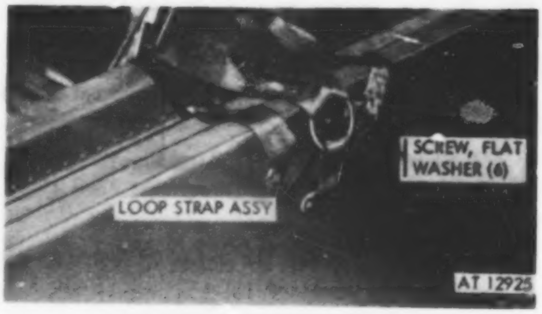


Figure 2-401. Spare tire webbing straps.

2-223. Cushion (Seat and Back)

Note. Procedures given in a(1) and (2) below pertain to removal of the left hand (driven) seat cushion. Right hand seat cushions are removed in the same manner.

a. Removal. Refer to figure 2-397 and proceed as follows:

(1) Remove two capscrews and lockwashers, remove seat cushion.

(2) Release fasteners and remove cushion cover.

Note. Backrest cushion and seat cushion are removed in the same manner.

b. Installation. Refer to removal procedures and reverse sequence of instructions.

2-224. Windshield Stowage Box

a. Removal (Fig. 2-398).

(1) Remove two nuts, four flat washers and two bolts (one on each side of vehicle).

(2) Remove six capscrews and flat washers that secure top of stowage box to cab rear panel; remove stowage box.

b. Installation. Refer to removal procedure and reverse sequence of instructions.

2-225. Troop Seat Locking Spring (Fig. 2-399)

a. Removal. Place troop seat in down position, pull spring apart and lift away from seat hind.

b. Installation. Pull spring apart and slip into position on seat hinge.

2-226. Side and Tailgate Seal (Fig. 2-400)

Note. The following procedures may be used for replacement of either the tailgate or side gate seals.

a. Removal.

(1) Disconnect air line fitting.

(2) Remove 90-degree elbow; remove locknut and washer from air seal fitting.

(3) Remove two screws and seal retainer from each end of seal; remove seal from tailgate and/or side gate channel member.

b. Cleaning. Clean seals with water and a mild detergent.

c. Installation.

Note. Seals are installed "dry"; do not use adhesives.

(1) Refer to removal procedures and reverse sequence of instructions.

(2) Check all connections for leaks (para 2-219*c*).

2-227. Spare Tire Webbing Straps

a. Removal (Fig. 2-401).

(1) Remove six screws and flat washers releasing loop and strap assembly.

(2) Disconnect strap assembly.

b. Installation. Refer to removal procedures and reverse sequence of instructions.

2-228. Engine Cover Gasket

a. Removal.

(1) Cut damaged part of gasket away.

(2) Scrape old adhesive from engine cover.

b. Installation.

(1) Cut new gasket segment to closely fit replacement area.

(2) Degrease bonding areas of both new gasket and engine cover.

(3) Apply an even coat of adhesive primer to bonding surfaces of new gasket and engine cover with a clean cloth or small paint brush.

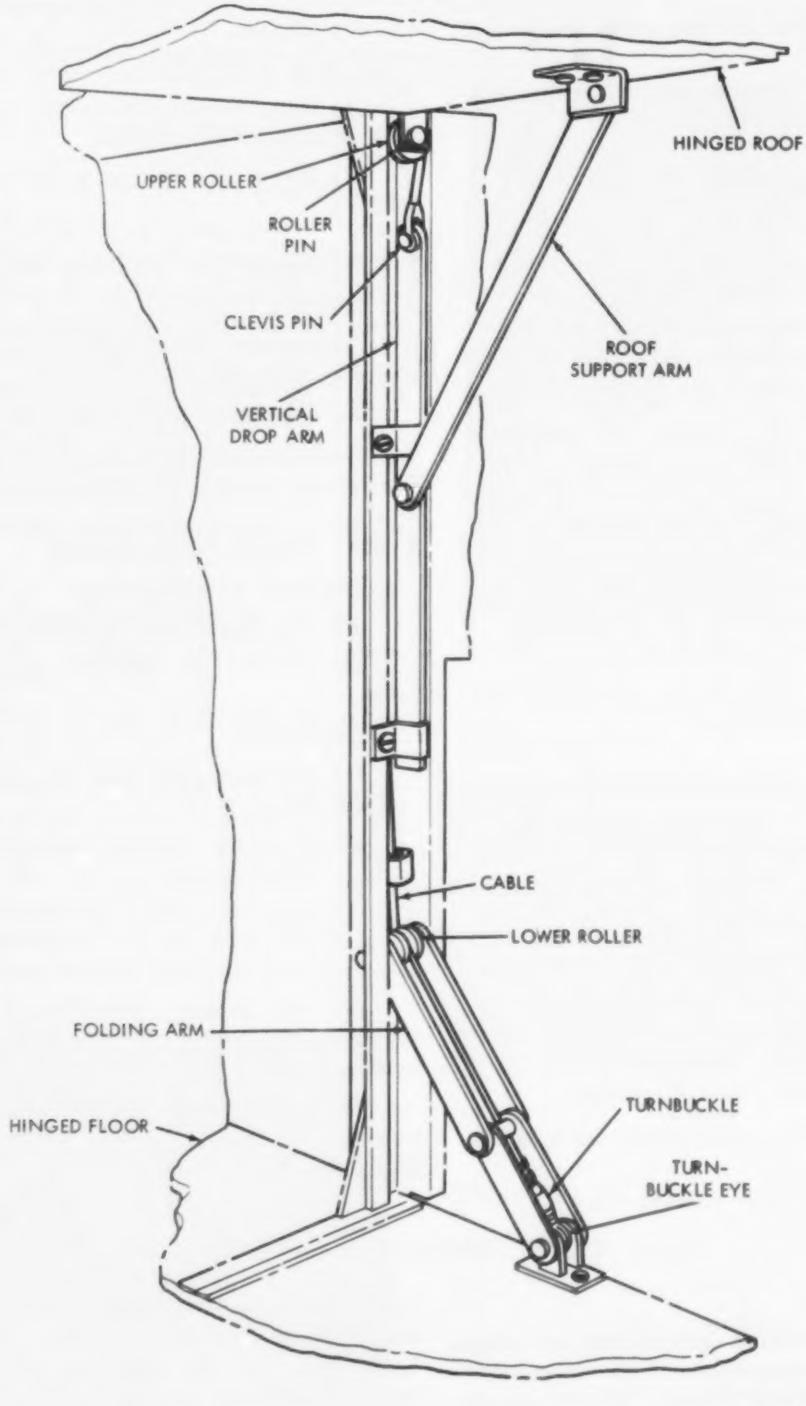
(4) Dry primer approximately 1/8-inch thickness of adhesive over bonding surfaces of both new gasket and engine cover.

(6) Firmly clamp new gasket in place for 24 hours; make sure all splices are completely filled with adhesive.

Section XXXIV. SPECIAL PURPOSE BODIES

2-229. General

This section contains instructions for removal, repair, and replacement of the components of the special purpose bodies. The components covered are: the side panel counterbalance cable, ladder locking clamp, side panel-to-roof toggle clamp, air conditioner door handle control, heater fuel filter, heater fuel pump, heater fuel shutoff valve, fuel tank-to-heater fuel lines and fittings, window glass and seal, window regulator, window blackout panel.


HINGED ROOF
UPPER ROLLER
ROLLER PIN
CLEVIS PIN
ROOF SUPPORT ARM
VERTICAL DROP ARM
CABLE
LOWER ROLLER
FOLDING ARM
TURNBUCKLE
HINGED FLOOR
TURN-BUCKLE EYE

AT 12926

Figure 2-402. Hinged roof and floor counterbalance mechanism.

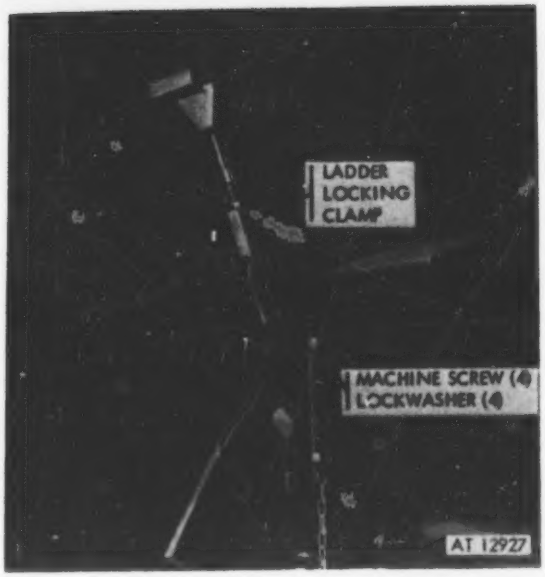

LADDER LOCKING CLAMP
MACHINE SCREW (4)
LOCKWASHER (4)
AT 12927

Figure 2-403. Ladder locking clamp.

2-230. Hinged Roof and Floor Counterbalance Cables (Fig. 2-402)

a. Removal.

(1) Place van side panel in fully expanded position.

(2) Secure end panels in open position.

(3) Support hinged roof with swivel hooks. Place 1-inch wood block between end swivel hook and hinged roof to release tension on counterbalance cable.

(4) Remove cotter pin, and clevis pin which attaches cable to vertical drop arm, and remove clevis from arm.

(5) Remove cotter pins and roller pins which attach upper and lower rollers to corner post and remove upper and lower rollers. Removal of the lower roller will release the lower folding arm.

(6) Unscrew lower cable end from turnbuckle.

(7) Withdraw cable upward through guides, and remove cable.

b. Installation.

(1) Remove turnbuckle eye from replacement cable.

(2) Thread turnbuckle end of cable downward through guides.

(3) Screw turnbuckle onto turnbuckle eye remaining in floor bracket, and screw turnbuckle end of cable into turnbuckle.

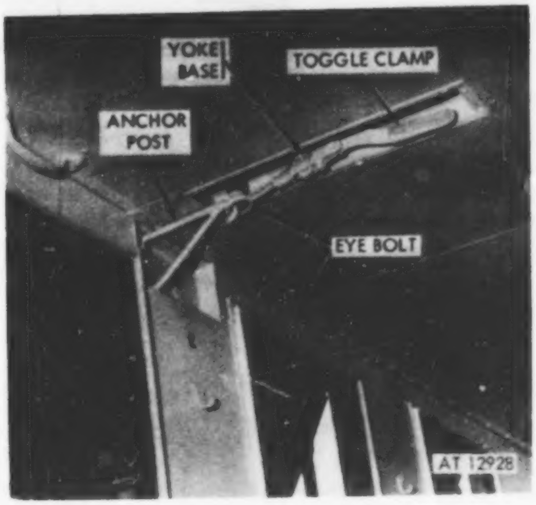

YOKE BASE
TOGGLE CLAMP
ANCHOR POST
EYE BOLT
AT 12928

Figure 2-404. Side panel-to-roof toggle clamp.

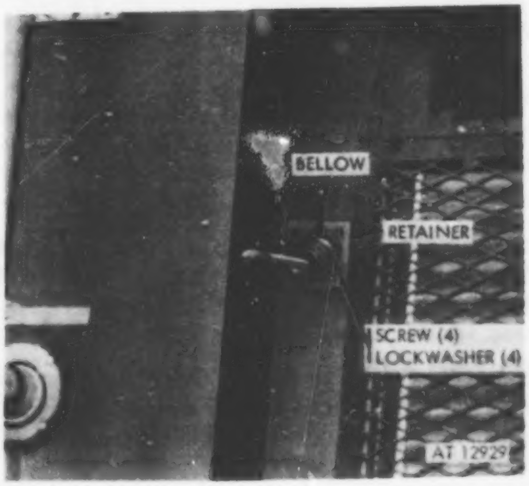

BELLOW
RETAINER
SCREW (4)
LOCKWASHER (4)
AT 12929

Figure 2-405. Bonnet front door control rod bellow.

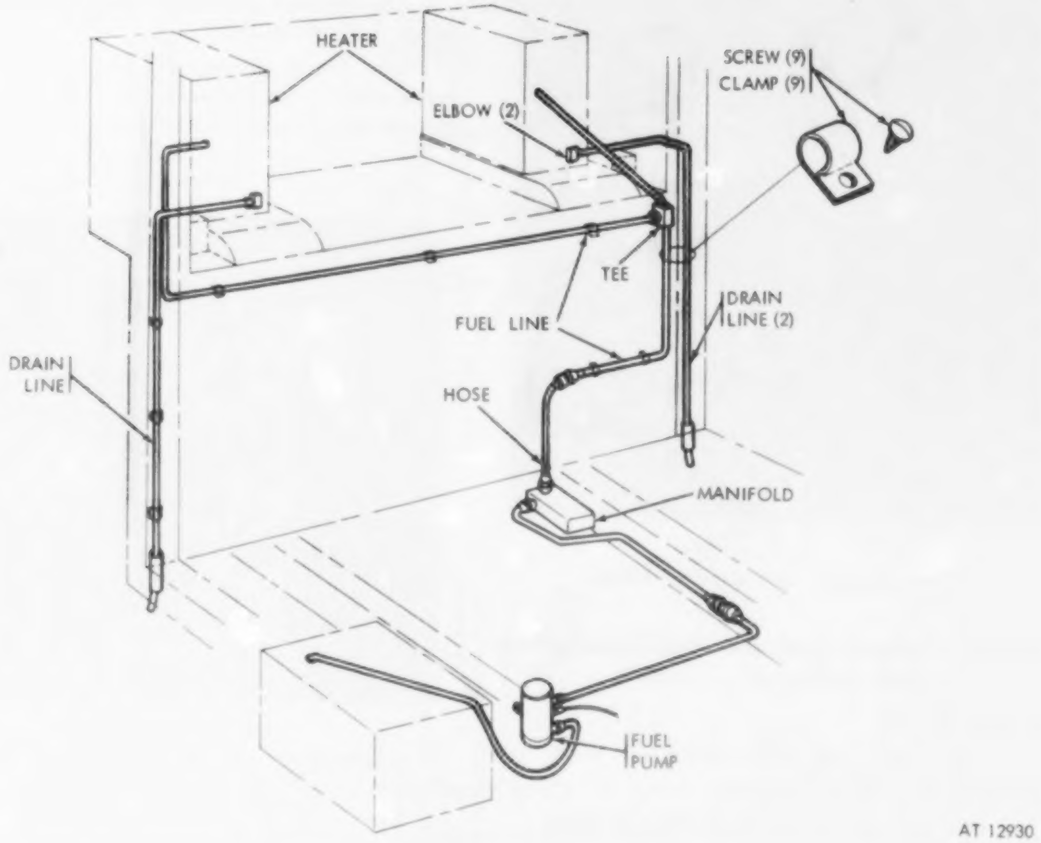


Figure 2-406. Fuel tank-to-heater fuel lines and fittings, removal and installation.

(4) Aline holes in end of folding arm with holes in corner post. Place roller in channel of folding arm with cable behind roller. Secure roller pin with 3/32 x 3/4 cotter pin.

(5) Position upper roller in roller mounting plate on corner post with cable in roller groove. Insert pin through roller and corner and secure pin with 3/32 x 3/4 cotter pin.

(6) Pull cable clevis down over end of vertical drop arm and aline holes in clevis and arm. Insert pin through holes and secure pin with 1/16 x 1/2 cotter pin.

(7) Tighten turnbuckle for proper cable tension.

2-231. Ladder Locking Clamp

a. Removal. Remove sir screws attaching cover plate to rear door and remove cover plate. Remove four machine screws and lockwashers attaching locking clamp to rear door, and remove locking clamp (fig. 2-403).

b. Installation. Position locking clamp on door and secure clamp to door with four machine screws and lockwashers.

2-232. Side Panel-To-Roof Toggle Clamp (Fig. 2-404)

a. Removal. Release clamp. Remove four screws which attach yoke base to roof section and remove clamp.

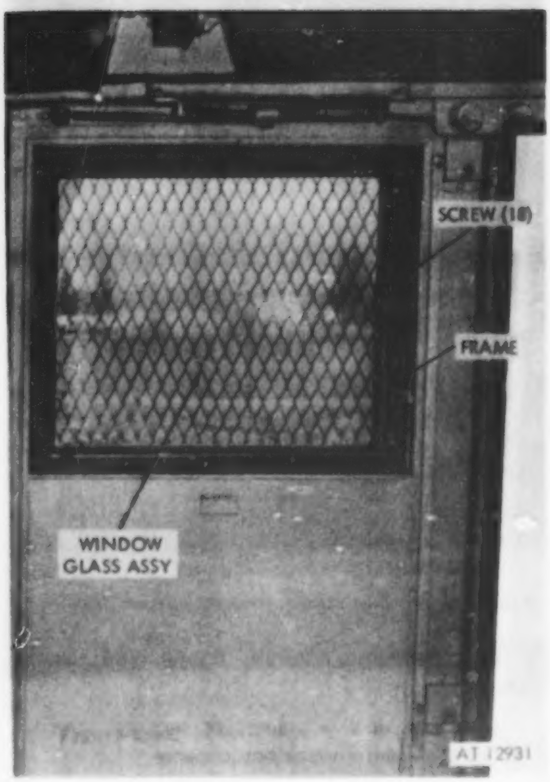


Figure 2-407. Stationary sash window glass, removal and installation.

b. Installation. Position yoke base with eyebolt toward anchor post and attach base with four screws.

2-233. Bonnet Control Rod Bellow (Fig. 2-405)

a. Removal.

(1) Open bonnet front door with bonnet front door control handle.

(2) Remove hooked end of control rod from control rod clip on door.

(3) Remove four screws and lockwashers attaching bellow retainer to front of air conditioner.

(4) Remove retainer and bellow.

b. Installation. Refer to removal procedure and reverse sequence.

2-234. Heater Fuel Filter

Refer to TM 5-4520-209-15 for service, removal, and installation procedures for the heater fuel filter.

2-235. Heater Fuel Pump

a. Plunger Spring and Filter Element Servicing.

(1) Remove cap from bottom of fuel pump.

(2) Wash filter element, spacer, spring and cover in mineral spirits paint thinner. Inspect filter element for damage; replace if necessary. Test action of spring. Replace weak, bent or broken spring.

(3) Install parts in reverse order of removal.

b. Replacement. For removal and installation procedures, refer to paragraph 2-55.

2-236. Fuel Tank-To-Heater Fuel Lines and Fittings (Fig. 2-406)

a. Removal.

(1) Disconnect fuel upper inlet lines and vent lines at heaters.

(2) Disconnect fuel upper inlet lines at tee fitting located at right front of van body.

(3) Remove clamps and straps securing fuel lines to outside of van body.

(4) Remove fuel upper inlet lines and vent lines through holes in van body bonnet.

(5) Remove tee fitting.

(6) Disconnect fuel lower inlet line at hose assembly connection. Remove lower inlet line.

(7) Disconnect hose assembly from fuel manifold on frame right side rail (band No. 18). Remove hose assembly.

b. Installation. Refer to removal procedure and reverse sequence.

2-237. Stationary Sash Window Glass (Fig. 2-407)

a. Removal. Remove 18 screws and remove window frame. Remove window glass assembly.

b. Installation. Install window glass assembly using caulking compound (MIL-C-18969). Position frame and secure with 18 screws.

2-238. Retractable Sash Window Glass (Fig. 2-408)

a. Removal.

(1) Fully open window.

(2) Brace window in open position and remove cotter pin securing window retracting mechanism to window frame. Discard cotter pin.

(3) Remove 18 screws and remove window frame. Remove window glass assembly.

b. Installation.

(1) Install window glass assembly using caulking compound (MIL-C-18969).

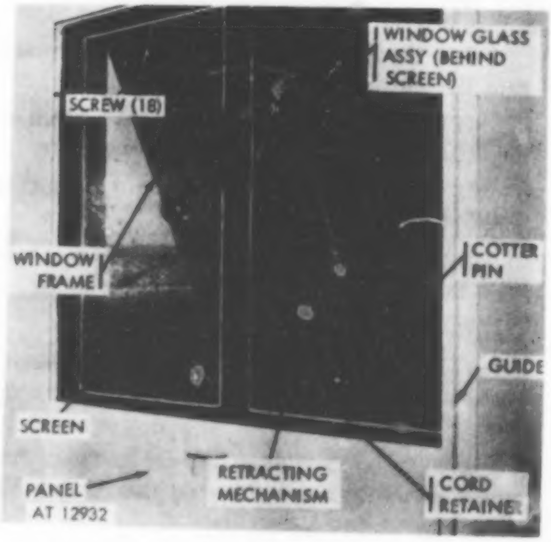

WINDOW GLASS ASSY (BEHIND SCREEN)
SCREW (18)
WINDOW FRAME
COTTER PIN
GUIDE
SCREEN
PANEL
RETRACTING MECHANISM
CORD RETAINER
AT 12932

Figure 2-408. Retractable sash window glass, blackout panel, and screws; removal and installation.

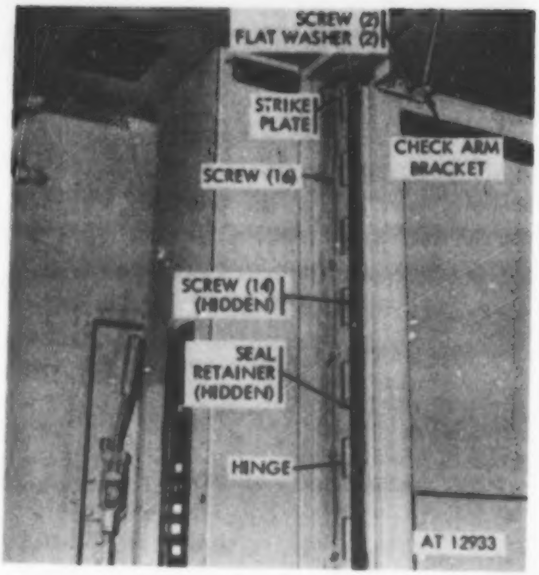

SCREW (2)
FLAT WASHER (2)
STRIKE PLATE
CHECK ARM BRACKET
SCREW (16)
SCREW (14) (HIDDEN)
SEAL RETAINER (HIDDEN)
HINGE
AT 12933

Figure 2-409. Door hinge, removal and installation.

(2) Position window frame and secure with 18 screws.

(3) Position window retracting mechanism and attach to window frame with cotter pin.

2-239. Window Blackout Panel (Fig. 2-408)

a. Removal.

(1) Remove 15 screws securing blackout panel guide to van body sidewall and remove guide and panel.

(2) Remove panel from guide.

b. Installation. Refer to removal procedure and reverse sequence.

2-240. Window Screen (Fig. 2-408)

a. Removal. Remove cord retainer from edge of window screen and remove screen.

b. Installation. Position screen in frame and cord retainer into space between screen and frame. Make certain screen is smooth and tight.

2-241. Door Hinge (Fig. 2-409)

a. Removal.

(1) Open door and remove two screws and flat washers attaching door check arm bracket and blackout switch strike plate to door. Remove bracket and strike plate.

(2) Remove 16 screws which attach door hinge to van body and remove door.

(3) Lift rubber door seal to reveal screws which attach hinge to door. Remove 14 screws, hinge seal, and seal retainer.

b. Installation.

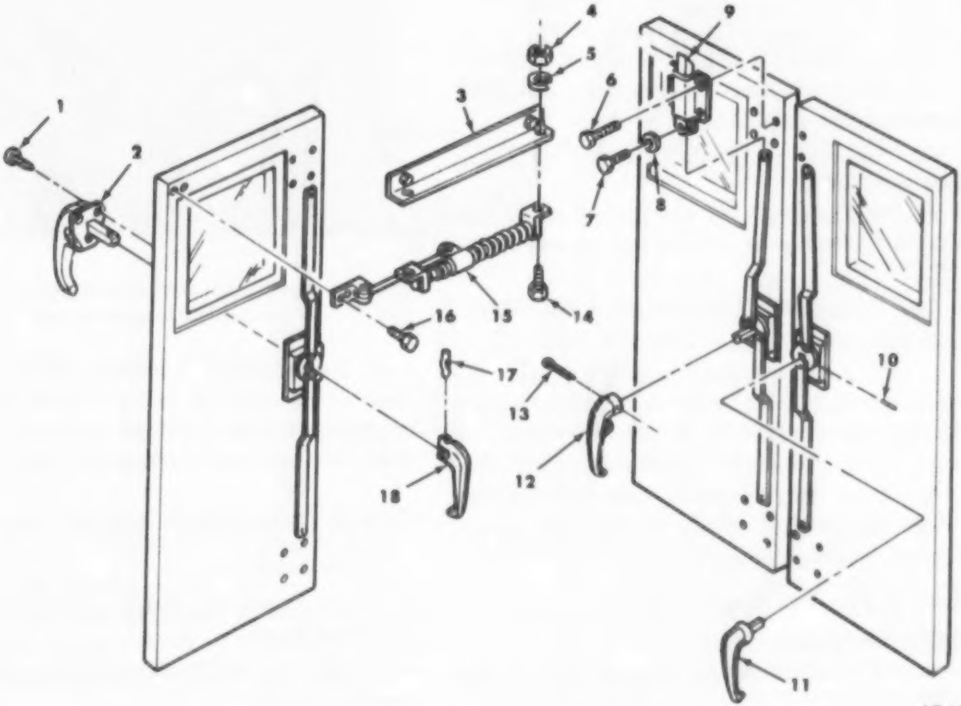
(1) Position flat rubber seal against back of hinge and place hinge against door with edge of hinge leaf flush with edge of seal.

(2) Position hinge and seal on door.

(3) Position half-round rubber seal along front of hinge leaf and place retainer over flap of half-round seal.

(4) Aline holes in retainer, hinge leaf, and door. Attach retainer and hinge to door with 14 screws.

(5) Position door and hinge against door post with flap rubber seal flush with edge of hinge leaf.



1—Screw (3)
2—Outer handle
3—Bracket
4—Nut (2)
5—Lockwasher (2)
6—Screw (4)
7—Screw
8—Washer
9—Bolt and case assembly
10—Groove pin
11—Handle
12—Handle
13—Cotter pin
14—Screw (2)
15—Check assembly
16—Screw (2)
17—Groove pin
18—Inner handle

Figure 2-410. Door locks, handles and checks, exploded view.

(6) Aline holes in hinge leaf with holes in door post and secure retainer, seals and hinge with 16 screws.

2-242. Door Handles and Checks

a. Slide Door Handles (Fig. 2-410)

Note. Key numbers in parentheses refer to figure 2-410.

(1) *Removal.*

Note. Left and right side door handles are removed in the same manner.

(*a*) Drive out groove pin (17) securing inner handle (18) to outer handle (2). Remove inner handle.

(*b*) Remove three screws (1) securing outer handle (2) to door. Remove outer handle.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Rear Left Door Handle (Fig. 2-410).

(1) *Removal.* Drive out groove pin (10) and remove handle (11).

(2) *Installation.* Install handle (11) and groove pin (10).

Note. For installation of new handle, drill ¼-inch hole in handle shaft using existing holes in case assembly for location.

c. Rear Right Door Handles (Fig. 2-410).

(1) *Removal.*

(*a*) Remove cotter pin (13) securing inner door handle (12) to outer door handle shaft. Remove inner door handle.

(*b*) Remove three screws securing outer door handle to door. Remove outer door handle.

(2) *Installation.* Refer to removal procedure and reverse sequence.

d. Door Checks (Fig. 2-410).

(1) *Removal.*

Note. All door checks are removed in the same manner.

(*a*) Remove two screws (16) securing door check (15) to upper edge of door.

(*b*) Remove two screws (14), nuts (4), and lockwashers (5) securing door check (15) to bracket (3). Remove door check.

(2) *Installation.* Refer to removal procedure and reverse sequence.

2-243. Doors and Panels Weather Strip (Fig. 2-411)

a. Removal. Remove screws and nuts securing seal retainer to panel or door and remove retainer and seal.

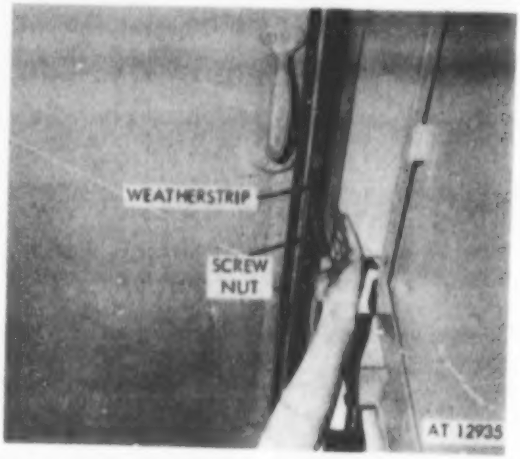


Figure 2-411. Door and panel weather strip, removal and installation, typical.

b. Installation. Position retainer over seal flap. Aline holes in retainer with holes in door or panel. Attach retainer and seal with screws and nuts removed during removal.

2-244. Drive Shaft Ratchet (Fig. 2-412)

a. Removal.

(1) Drive out taper pin attaching ratchet to drive shaft.

(2) Tap ratchet free from shaft and remove ratchet.

b. Installation.

(1) Position rachet on drive shaft with teeth facing toward pawl and with taper pin holes alined.

(2) Secure ratchet to drive shaft with taper pin.

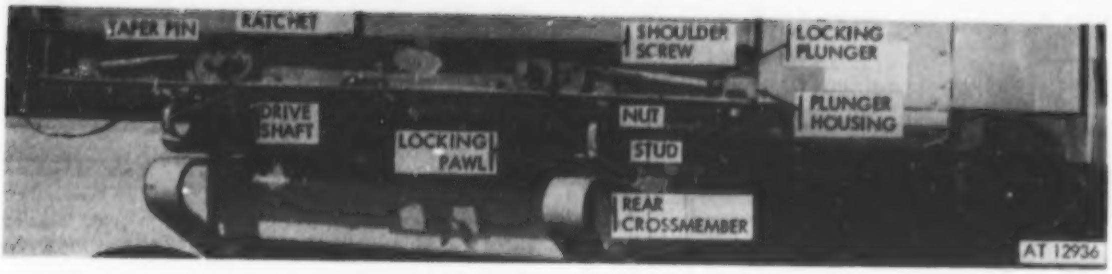


Figure 2-412. Drive shaft ratchet and ratchet lock.

2-245. Drive Shaft Ratchet Lock (Fig. 2-412)

a. Drive Shaft Locking Pawls.

(1) *Removal.*

(*a*) Remove special shoulder screw which attaches locking pawl to underframe rear crossmember.

(*b*) Disengage locking plunger from pawl and remove pawl.

(2) *Installation.*

(*a*) Engage slot in pawl with locking plunger.

(*b*) Secure pawl to crossmember with special shoulder screw.

b. Drive Shaft Locking Plungers.

(1) *Removal.*

(*a*) Remove self-locking nut which attaches locking plunger housing to stud on rear crossmember.

(*b*) Disengage plunger from slot in pawl and remove plunger housing from stud.

(2) *Installation.*

(*a*) Engage plunger in slot in pawl, then depress plunger until it is possible to attach plunger housing to stud or rear crossmember.

(*b*) Secure housing to stud with self-locking nut.

2-246. Side Panel Locks (Fig. 2-413)

a. Side Panel Rear Locks.

(1) *Removal.*

(*a*) Remove eight screws attaching lock cover plate to panel and remove cover plate. Remove insulating material.

(*b*) Remove two screws attaching lock bolt retainer to edge of door frame.

(*c*) Remove cotter pins from clevis pins, remove clevis pins, and separate clevises from lock.

(*d*) Remove self-locking nut and washer securing lock handle shank in lock.

(*e*) Remove four nuts and lockwashers which attach lock to van body and remove lock.

(2) *Installation.*

(*a*) Slide lock bolt retainer onto lock bolt with plate toward end of bolt.

(*b*) Position lock on lock handle shank and four corner studs.

(*c*) Slide lock bolt retainer into position against inside of door frame and attach with two screws inserted from outer edge of door frame.

(*d*) Attach lock to van body with four lockwashers and four selflocking nuts.

(*e*) Secure lock handle shank to lock with a washer and selflocking nut.

(*f*) Aline holes in clevises with holes in lock arms and insert clevis pins. Secure clevis pins with cotter pins. Replace insulating material previously removed.

(*g*) Attach lock cover plate to panel with eight screws.

b. Side Panel Front Locks and Hinged Roof Locks.

(1) *Removal.*

(*a*) Remove eight screws attaching lock

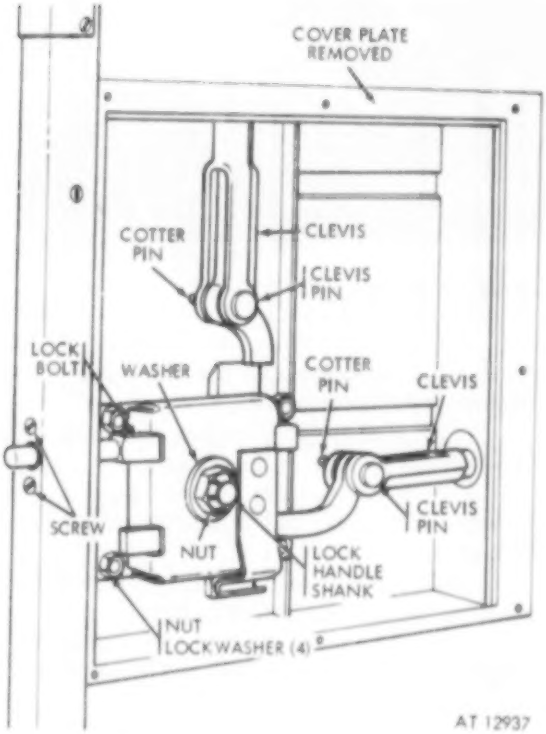


Figure 2-418. Side panel locks.

cover plate to panel and remove cover plate. Remove insulating material from lock recess.

(*b*) Remove cotter pins from clevis pins, remove clevis pins, separate clevis from the lock.

(*c*) Remove self-locking nut securing lock handle shank in lock.

(*d*) Remove four nuts and lockwashers attaching lock to van body and remove lock.

(2) *Installation.*

(*a*) Position lock on lock handle shank and four corner studs and attach it to van body with four lockwashers and four self-locking nuts.

(*b*) Secure lock handle shank to lock with a washer and self-locking nut.

(*c*) Aline holes in clevises with holes in lock arms and insert clevis pins. Secure clevis pins with cotter pins. Replace insulating material previously removed.

(*d*) Attach lock cover plate to panel with eight screws.

2-247. Heater Fuel Pump Power Supply

Refer to TM 5-4520-209-15 for removal and installation instructions for the heater fuel pump power supply.

2-248. Electrical Wiring (24-Volt)

a. Removal.

(1) Disconnect input plug at van body front wall.

(2) Remove leads from truck electrical system. Tag ends of wires.

(3) Remove connectors from 24-volt dc circuit breakers and fuel pump.

(4) Release harness from six attaching clamps and remove.

b. Installation.

(1) Insert plug into socket in van body front wall.

(2) Thread harness through six attaching clamps and tighten clamps.

(3) Attach harness connectors to circuit breakers.

(4) Attach the harness to truck electrical system at same location as tagged in *a*(2) above.

2-249. Clearance Lights (Fig. 2-414)

a. Removal.

(1) Remove two screws attaching lens housing to base and remove housing.

(2) Remove four screws attaching light base to body and separate base from the body.

(3) Disconnect bayonet-type connectors joining base to lighting harness cable and remove base.

b. Installation.

(1) Connect bayonet-type connectors joining base to lighting harness cable (circuit No. 482 for clearance light, and 490 for blackout light).

(2) Attach base to body with four screws.

(3) Attach lens housing to base with two screws.

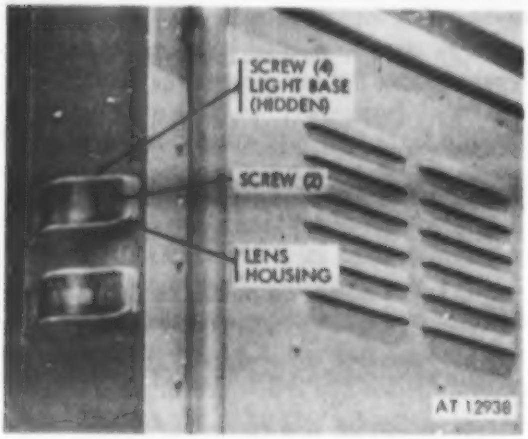


Figure 2-414. Clearance lights.

2-250. Fluorescent Light Fixture (Fig. 2-415)

a. Removal.

(1) See that main power switch is in "OFF" position.

(2) Remove 10 screws attaching light fixture to ceiling and separate fixture from ceiling.

(3) Loosen wire nuts and disconnect two electrical wires from light fixture wires. Note location of connections for installation.

b. Installation.

(1) Connect two electrical wires 650 and GND, to light fixture wires with two wire nuts.

(2) Attach fixture to ceiling with 10 screws.

c. Replacement of Fluorescent Light Tubes.

(1) Loosen two screws and open hinged mesh guard.

(2) Spread retaining terminals and remove tube.

(3) Install replacement 15-watt fluorescent tube by snapping it into retaining terminals.

(4) Press terminals together.

(5) Close mesh guard and secure it with two screws.

d. Replacement of Starter.

(1) Loosen two screws and open hinged mesh guard.

(2) Remove fluorescent tube (*c* above).

(3) Turn starter one-quarter turn counterclockwise and remove starter from fixture.

(4) Position new starter in fixture and turn starter one-quarter turn clockwise.

(5) Install fluorescent tube (*c* above).

(6) Close mesh guard and secure it with two screws.

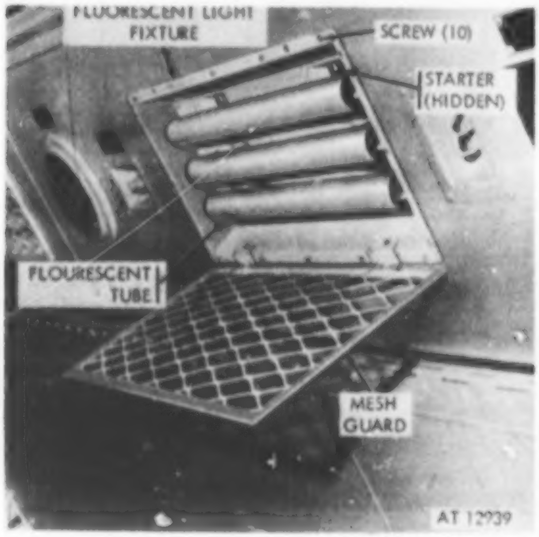


Figure 2-415. Fluorescent light fixture and tubes.

2-251. Dome Light Lens and Lamp

a. Replacement of Lens (Fig. 2-416).

(1) Loosen ring door locking screw and open ring door.

(2) Pull lens retaining clip from ring door and remove lens.

(3) Position white lens in emergency

light ring door, or blue lens in blackout light ring door, and secure with lens retaining clip.

(4) Close ring door and tighten ring door locking screw.

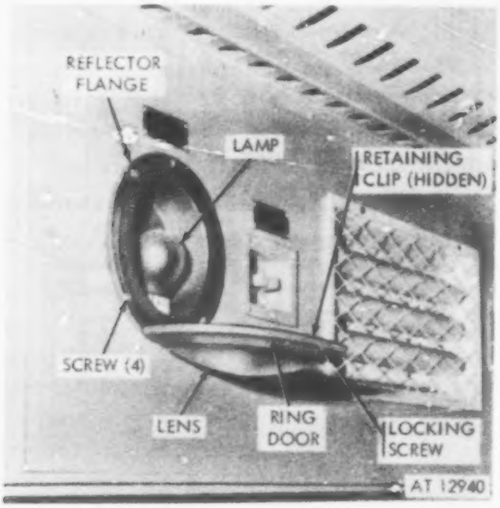

REFLECTOR FLANGE
LAMP
RETAINING CLIP (HIDDEN)
SCREW (4)
LENS
RING DOOR
LOCKING SCREW
AT 12940

Figure 2-416. Dome light lens, replacement.

b. Replacement of Lamp.

(1) Loosen ring door locking screw. Open ring door and remove lamp.

(2) Install a 60-watt white frosted lamp in emergency light fixture or a 25-watt blue lamp in blackout light fixture.

(3) Close and secure ring door.

2-252. Dome Light (Fig. 2-416)

a. Removal.

(1) Position main power switch in "OFF" position. Loosen ring door locking screw and open ring door.

(2) Remove four screws in reflector flange attaching fixture to ceiling and separate fixture from the ceiling.

(3) Disconnect electrical wires from socket terminals. Note location of connections for installation.

b. Installation.

(1) Emergency light: connect wires 652-B and GND to socket terminals from which they were removed. Blackout light: connect wires 647 and GND to socket terminals from which they were removed.

(2) Attach fixture to ceiling with four screws.

(3) Close ring door and tighten ring door locking screw.

2-253. Light Switch (110-Volt) (Fig. 2-417)

a. Removal.

(1) Position main power switch in "OFF" position.

(2) Remove three screws attaching cover plate to switch and remove cover plate.

(3) Remove two screws attaching switch to switch box and separator switch from box.

(4) Disconnect three electrical wires from switch terminals. Note location of connections for installation.

b. Installation.

(1) Connect electrical wires 651, 651A and 652 to switch terminals from which they were removed.

(2) Attach switch to switch box with two screws.

(3) Attach cover plate to switch with three screws.

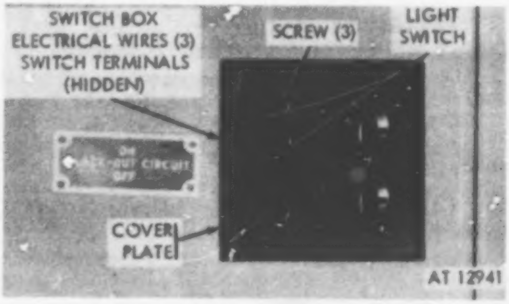

SWITCH BOX
ELECTRICAL WIRES (3)
SWITCH TERMINALS
(HIDDEN)
SCREW (3)
LIGHT SWITCH
COVER PLATE
AT 12941

Figure 2-417. Light switch (110-volt).

2-254. Phone Jack (Fig. 2-418)

a. Inside Telephone Jack Posts.

Note. Inside jack posts are located on the van ceiling panel at the left of the air conditioning duct and on the van left rear panel immediately below the fire extinguisher.

(1) *Removal.*

(*a*) Remove four screws attaching jack post box to ceiling (or rear panel) and separate box from panel.

(*b*) Remove two screws attaching connecting wires to jack posts and disconnect the wires.

(*c*) Remove two nuts holding jack posts in box and remove posts from box.

(2) *Installation.*

(*a*) Insert jack posts through rubber grommets in box and secure each with nut.

(*b*) Connect wires to jack posts with two roundhead screws.

(*c*) Position box in panel (or ceiling) and secure it with four screws.

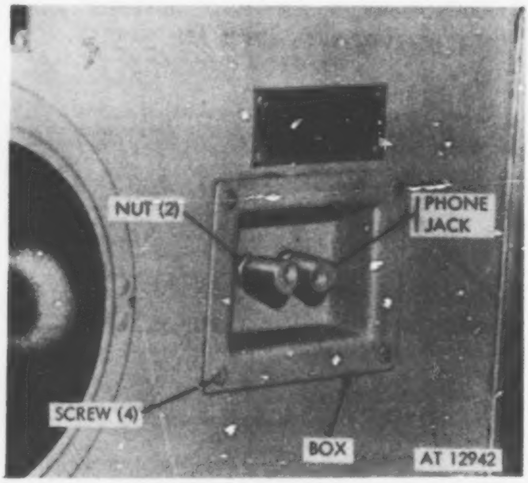


Figure 2-418. Phone jack.

b. Outside Telephone Jack Posts.

Note. The outside jack posts are located on the outside left rear panel in line with the rear inside jack posts.

(1) *Removal.*

(*a*) Remove four screws attaching rear inside jack-post box to panel and remove box.

(*b*) Remove screws attaching connecting wires to outside jack posts and disconnect wires.

(*c*) Remove nuts holding the outside jack posts in box.

(*d*) Open spring-hinged cover on left rear panel and withdraw outside jack posts.

(2) *Installation.*

(*a*) Open spring-hinged cover on left rear panel and insert jack posts through rubber grommets in box.

(*b*) Secure outside jack posts in box with hex nuts.

(*c*) Connect wires to outside jack posts with screws.

(*d*) Position rear inside box on panel and secure with four screws.

2-255. Power Cable (Fig. 2-419)

a. Removal.

(1) Remove cable reel cover.

(2) Remove cotter pin from reel outer bearing support.

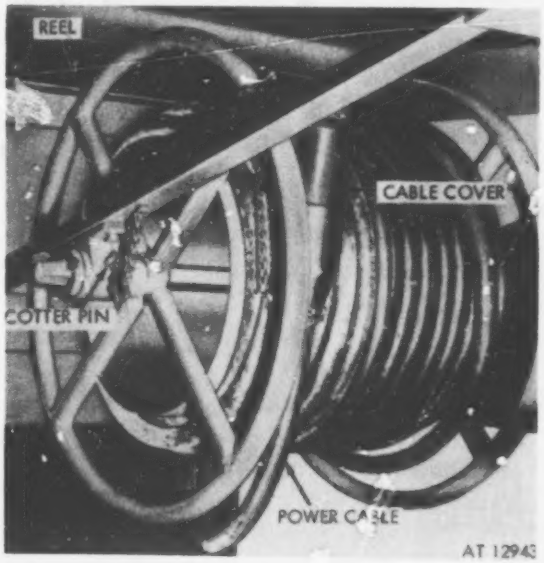


Figure 2-419. Power cable.

(3) Loosen strap holding end of cable to reel.

(4) Remove cable from reel drum.

b. Installation.

(1) Place end of cable into hole in reel drum, reel cable onto drum, and secure free end with strap.

(2) Lock reel by inserting cotter pin through hole in outer bearing support and reel shaft.

(3) Cover reel with the cover.

Section XXXV. WINCH AND POWER TAKEOFF

2-256. General

This section covers removal and installation procedures for the winch, winch cable, power takeoff and reverse gearbox controls and linkage, propeller shafts and universal joint, and pillow blocks. Replacement procedures are provided for drive shaft and universal joint spider assemblies. Adjustment and replacement procedures are also provided for the winch automatic brake band.

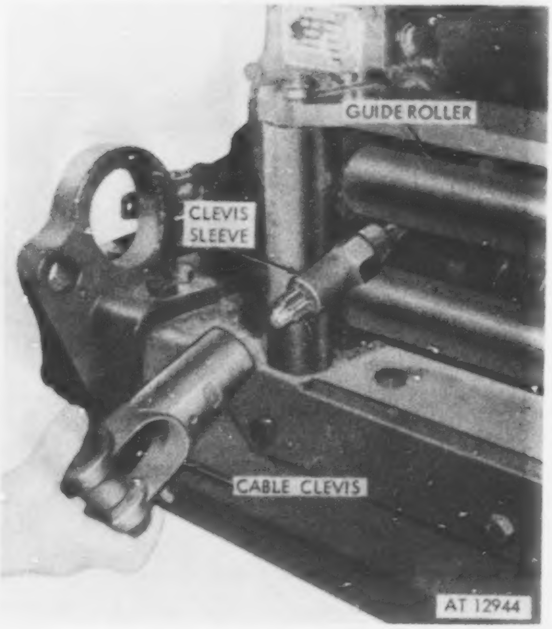


Figure 2-420 Removing cable clevis.

2-257. Winch and Cable Assembly

a. Service. Refer to LO 9-2320-230-12 for service procedures performed on the winch.

b. Removal.

(1) Remove cable clevis by rotating counterclockwise.

(2) Pull cable end, with clevis sleeve attached, through cable guide rollers (fig. 2-420).

(3) Remove radiator brush guard (para 2-210).

(4) Using drive punch (5120-541-7704), remove shearpin securing universal joint to winch gearbox drive shaft (fig. 2-421).

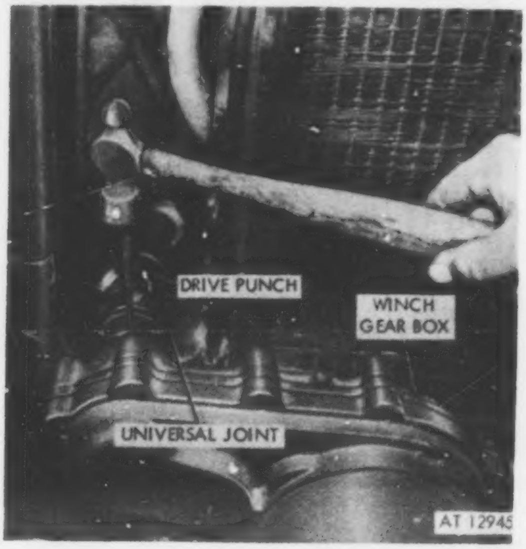


Figure 2-421. Removing winch drive shearpin.

(5) Remove nut, lockwasher, and screw securing universal joint to winch gearbox drive shaft.

(6) Separate universal joint from gearbox drive shaft, raise front end of propeller shaft, and tie out of way.

(7) Remove two locknuts securing winch drum locking lever to extension rod (fig. 2–422). Remove lever.

(8) Loosen locknut on winch side of extension (fig. 2–422). Unscrew extension and remove.

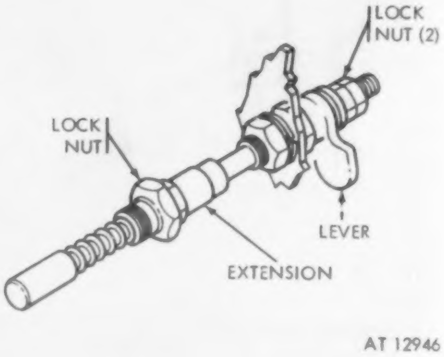

LOCK NUT (2)
LOCK NUT
LEVER
EXTENSION
AT 12946

Figure 2–422. Disassembly of winch drum locking mechanism.

(9) Remove two screws, lockwashers and flat washers securing center flotation box to winch channel brace at rear of winch. On the XM757 and XM791 vehicles these bolts retain a baffle.

(10) Attach hoisting equipment to winch and hoist until slack is removed from hoisting chain or cable.

(11) Remove three screws, lockwashers, and flat washers securing left flotation box to brace (fig. 2–423).

(12) Repeat operation (11) for right flotation box.

(13) Remove two nuts, screws, flat washers, and lockwashers securing left flotation box brace to frame.

(14) Using wood blocks, wedge flotation box braces approximately 1-inch away from frame.

SCREW (3)
LOCK WASHER (3)
FLAT WASHER (3)
AT 12947

Figure 2–423. Left flotation box.

(15) Remove four screws and lockwashers securing winch to upper edge of frame extension (fig. 2–424).

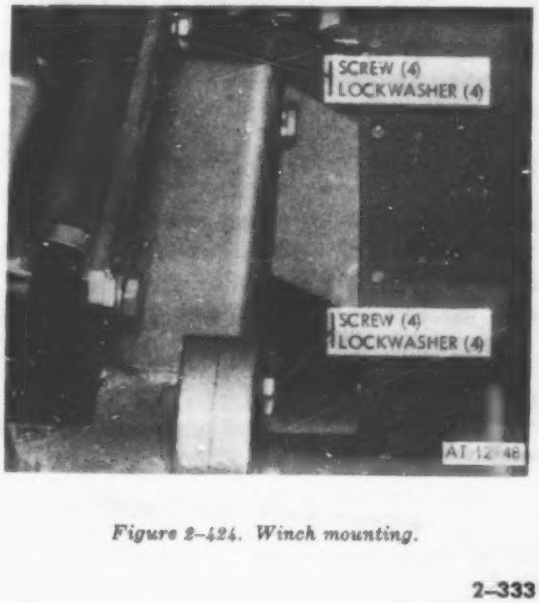

SCREW (4)
LOCKWASHER (4)
SCREW (4)
LOCKWASHER (4)
AT 12948

Figure 2–424. Winch mounting.

(16) Remove four screws and lockwashers securing winch to lower edge of frame extension.

(17) Using hoist, remove winch from vehicle being careful not to damage drum lock shaft.

(18) Remove and retain shims located between left side of winch and frame rail.

c. Installation.

(1) Refer to removal procedure and reverse sequence.

(2) Install four screws and lockwashers securing winch to right frame rail extension. Measure space between winch and left frame rail and install shims as required.

(3) Install four remaining screws securing left side of frame rail extension.

(4) Tighten screws securing winch to frame to 58-64 lb-ft.

(5) Tighten locknut securing drum latch mechanism.

2-258. Automatic Brake Band

a. Adjustment. To increase braking action of automatic brake, turn adjusting bolt clockwise ½ turn, and test brake adjustment.

Note. Do not turn adjusting bolt more than ½ turn before testing.

b. Removal.

(1) Remove six screw and lockwasher assemblies securing automatic brake cover to winch (fig. 2-425).

(2) Remove cover and gasket. Discard gasket.

(3) Remove adjusting screw, flat washer, and spring (fig. 2-426). Remove and discard packing.

(4) Slide brake band assembly off brakedrum.

c. Installation.

(1) Refer to removal procedure and reverse sequence.

(2) Install new packing and gasket.

(3) Tighten cover screws to 6.5-8 lb-ft.

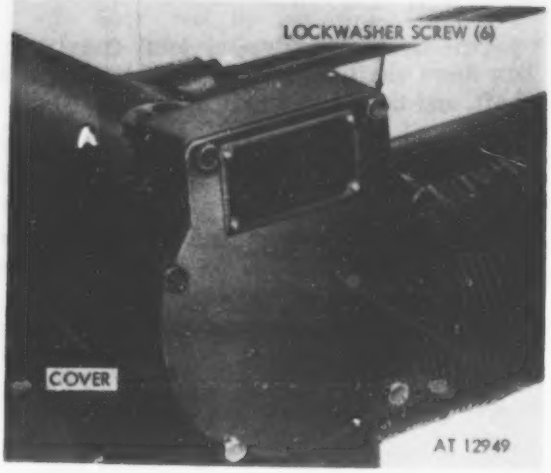


Figure 2-425. Automatic brake.

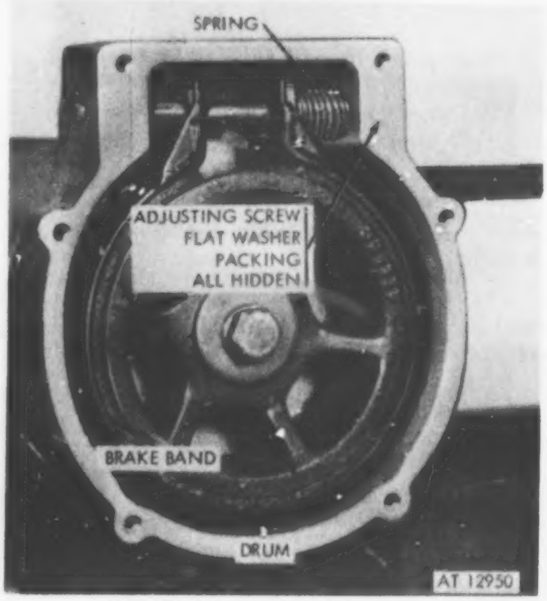


Figure 2-426. Removal or installation of automatic brake band.

2-259. Winch Cable

a. Removal (Fig. 2-427).

(1) Completely unwind cable from drum. Refer to TM 9-2320-230-10.

(2) Remove hex-socket setscrew from winch drum, and pull end of cable from hole in drum. Remove cable from roller guide.

b. Installation. Refer to removal procedure and reverse sequence.

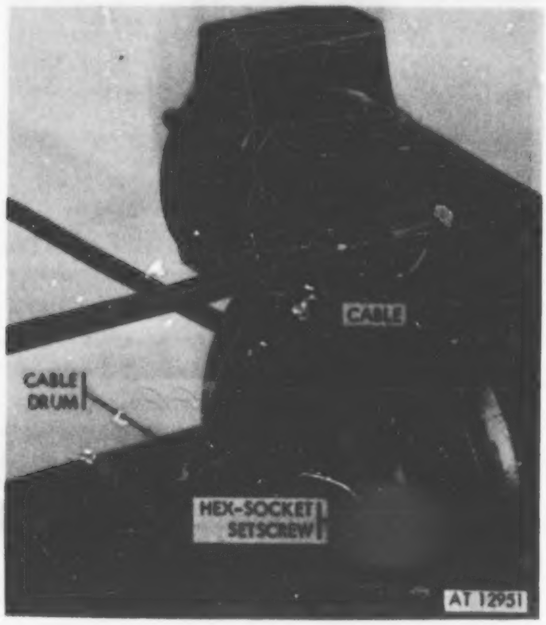


Figure 2-427. Removal or installation of winch cable.

2-260. Power Takeoff and Reverse Gearbox (Service)

Refer to LO 9-2320-230-12 for service procedures performed on the reverse gearbox.

2-261. Power Takeoff and Reverse Gearbox Controls and Linkage

a. Adjustment.

(1) *Power takeoff (fig. 2-428).*

(*a*) Remove cotter pin and clevis pin securing control cable clevis to PTO control lever. Discard cotter pin.

(*b*) Loosen adjusting and locking nuts on cable control clevis.

(*c*) Place PTO handle in up position.

(*d*) Place PTO control lever in engaged position detent.

(*e*) Turn cable clevis nuts to lengthen or shorten cable until holes in clevis aline with hole in control arm.

(*f*) Install clevis pin and cotter pin.

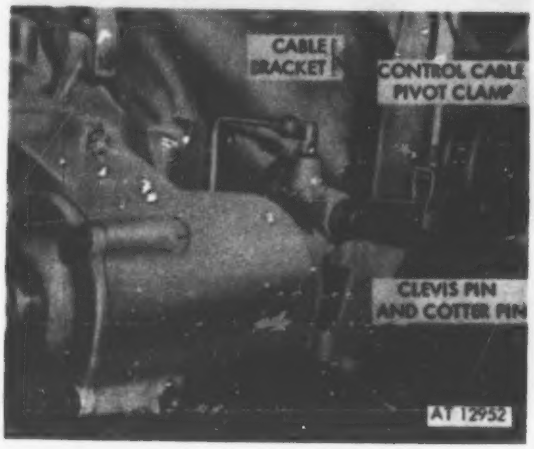


Figure 2-428. Power takeoff control cable.

(2) *Reverse gearbox (fig. 2-429).*

(*a*) Remove cotter pin and clevis pin securing control cable clevis to reverse gearbox control lever. Discard cotter pin.

(*b*) Loosen adjusting and locking nuts on cable control clevis.

(*c*) Place reverse gearbox handle in full down position.

(*d*) Place reverse gearbox shift lever in fully engaged position.

(*e*) Turn cable clevis nuts to lengthen or shorten cable until holes in clevis aline with hole in control arm.

(*f*) Install clevis pin and cotter pin.

Note. When the PTO or reverse gearbox control cable require greater shortening or lengthening it may be accomplished by adjusting the clevis on the opposite end of the cable using the same procedures.

b. Removal.

(1) Disconnect handle and shaft by re-

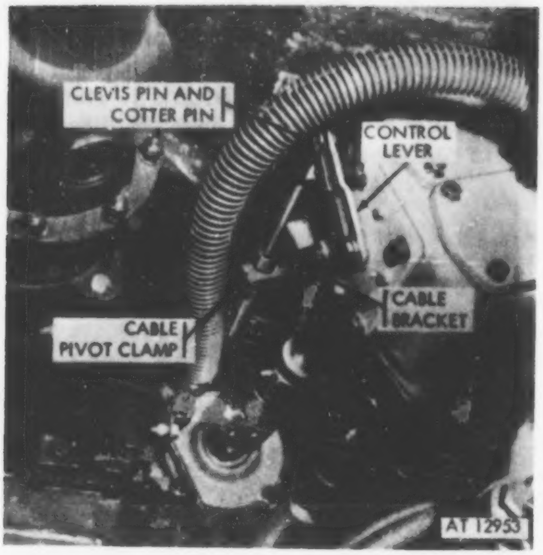

CLEVIS PIN AND COTTER PIN
CONTROL LEVER
CABLE BRACKET
CABLE PIVOT CLAMP
AT 12953

Figure 2-429. Reverse gearbox control cables.

moving cotter pin and clevis pin. Discard cotter pin (fig. 2-430).

(2) Remove two locknuts and clevis from end of control cable.

(3) Remove nut, lockwasher, flat washer, and gasket securing control cable assembly to cab floor. Discard gasket.

(4) Push control cable assembly down through cab floor.

(5) Remove cable from clamp securing winch control cables to cab.

(6) Disconnect control cable from power takeoff by removing cotter pin and clevis pin (fig. 2-428). Discard cotter pin

(7) Remove cotter pin securing power takeoff pivot clamp to bracket and remove clamp (fig. 2-429). Discard cotter pin.

(8) Disconnect control cable from reverse gearbox by removing cotter pin and clevis pin (fig. 2-429). Discard cotter pin.

(9) Remove cotter pin securing reverse gearbox pivot clamp to bracket and remove clamp (fig. 2-420). Discard cotter pin.

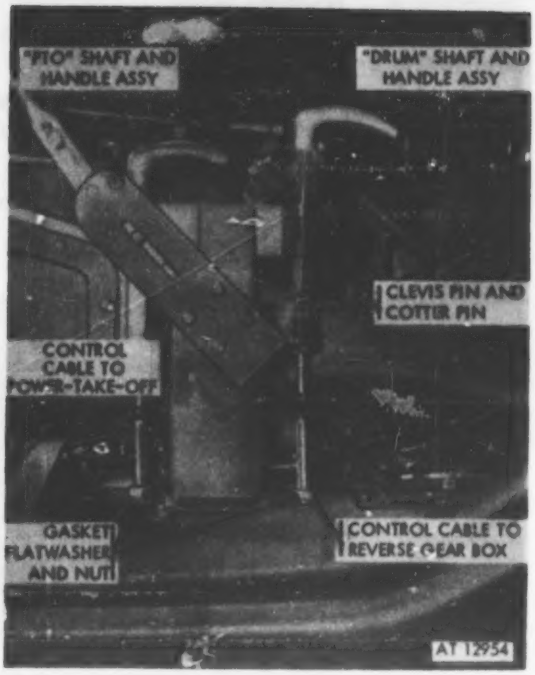

"PTO" SHAFT AND HANDLE ASSY
"DRUM" SHAFT AND HANDLE ASSY
CLEVIS PIN AND COTTER PIN
CONTROL CABLE TO POWER-TAKE-OFF
GASKET FLATWASHER AND NUT
CONTROL CABLE TO REVERSE GEAR BOX
AT 12954

Figure 2-430 Winch control handles.

c. Installation.

(1) Refer to removal procedure and reverse sequence.

(2) Install new cotter pins in pivot clamps and clevises.

(3) Install new gasket where control cables pass through cab floor.

(4) Tighten nuts securing control cables to cab floor.

(5) Secure control cables and clamp to cab.

2-262. Propeller Shafts

a. Removal.

(1) *Power takeoff to reverse gearbox.*

(*a*) Remove screw nut and lockwasher securing yoke on each end of power takeoff drive shaft (fig. 2-431).

(*b*) Remove power takeoff drive shaft.

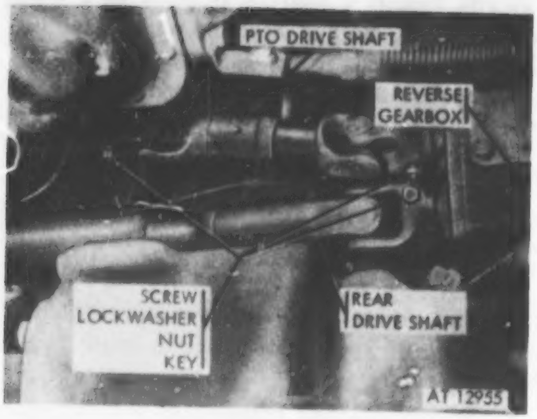


Figure 2-431. Power takeoff ana reverse gearbox drive shaft connections.

Remove keys from power takeoff output shaft and reverse gearbox upper input shaft.

(2) *Winch front drive shaft.*

(*a*) Disconnect universal joint from winch (para 2-257*b*(4) through para 2-257*b*(5)).

(*b*) Remove nut, lockwasher, and screw securing front drive shaft yoke to intermediate drive shaft (fig. 2-432).

(*c*) Remove front drive shaft. Remove key from keyway in intermediate drive shaft.

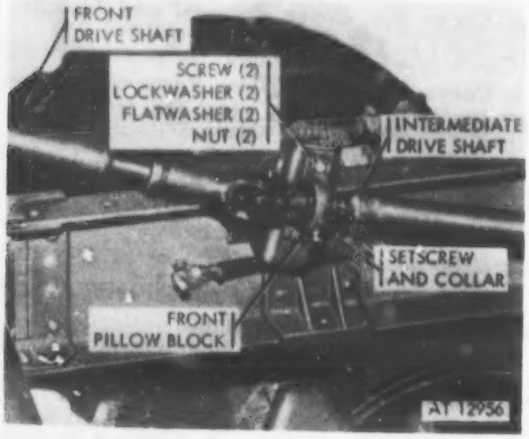


Figure 2-432. Winch drive shaft connections, typical.

(3) *Winch intermediate drive shaft.*

(*a*) Remove front drive shaft rear "U" joint from intermediate drive shaft.

(*b*) Loosen setscrew and collar in front pillow block (fig. 2-432).

(*c*) Remove nut, lockwasher, and screw securing intermediate drive shaft yoke to rear drive shaft. Disconnect yoke and remove key from keyway in rear drive shaft.

(*d*) Slide intermediate drive shaft out of front pillow block.

(4) *Winch rear drive shaft.*

(*a*) Remove intermediate drive shaft rear "U" joint from rear drive shaft (3) above.

(*b*) Loosen setscrew and collar in rear pillow block (fig. 2-432).

(*c*) Remove nut, lockwasher, and screw securing rear drive shaft to reverse gearbox lower shaft (fig. 2-432). Disconnect yoke and remove key from keyway in reverse gearbox lower shaft.

(*d*) Slide rear drive shaft out of rear pillow block.

b. Installation.

(1) Refer to removal procedure and reverse sequence.

(2) When installing shaft ends of rear and intermediate drive shafts in pillow blocks, slide shafts through bearing collars, install "U" joint assembly and maintain 3 1/2 inches from center line of "U" joint assembly and maintain 3 1/2 inches from center line of "U" joint and center line of pillow block.

(3) Tighten shaft yoke screws.

2-263. Universal Joint Assemblies

a. Removal.

Note. Removal procedures for winch drive shaft and universal joint spider assemblies are identical.

(1) Remove four retaining rings securing cross and bearing (fig. 2-433) to yoke.

(2) Force bearing assembly from yokes far enough to permit removal.

(3) Remove opposite bearing from yoke. Remove cross from yoke.

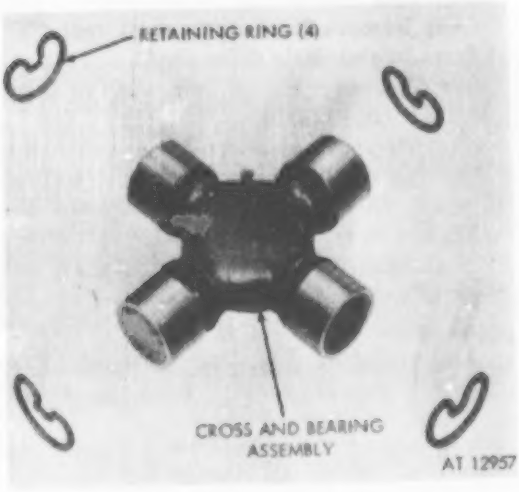


Figure 2-433. Removal or installation of cross and bearing assembly, typical.

b. Installation.

Note. Installation procedures for all winch drive shaft and universal joint assemblies are identical.

(1) Position cross in yoke.

(2) Install a bearing in yoke over each end of cross. Secure bearing with retaining ring.

Note. Insure that retaining ring engages groove in bearing.

2-264. Pillow Block

Note. Removal and installation procedures for front and rear pillow blocks are identical.

a. Removal.

(1) Remove winch drive shafts to the extent necessary for access to pillow block (para 2-262).

(2) Remove two screws, lockwashers, flat washers, and nuts securing pillow block to mounting bracket (fig. 2-432). Remove pillow block.

b. Installation.

(1) Refer to removal procedure and reverse sequence.

(2) Tighten mounting screws.

Section XXXVI. CAB AND BODY ACCESSORY ITEMS

2-265. General

This section contains instructions for the removal and installation of body and cab accessory items. These items include: the cab and cargo box covers, bows, and bilge pumps; mirrors, reflectors, and data plates; windshield wiper motor, arm, blade, control, lines and fittings.

2-266. Cab Cover and Bows

a. Cover Removal and Installation. Refer to TM 9-2320-230-10.

b. Cab Cover Bows.

(1) *Removal.*

(*a*) Refer to TM 9-2320-230-10 and remove four rods, two frame assemblies and bow.

(*b*) Remove four screws and lockwashers securing bar to cab, and remove bar.

(2) *Installation.* Install the cab bows in the reverse order of removal. Refer to paragraph 2-216 for adjustment of door glass.

2-267. Cargo Box Cover and Bows

a. Cargo Box Cover Removal and Installation. Refer to TM 9-2320-230-10.

b. Cargo Box Cover Bows Removal and Installation. Refer to TM 9-2320-230-10.

2-268. Windshield Wiper Arm and Blade (Fig. 2-434)

a. Removal.

(1) Remove screw and nut securing wiper blade to arm, and remove blade.

(2) Remove nut securing arm to wiper motor, and remove arm.

b. Installation. Install the wiper arm and blade in the reverse roder of removal.

c. Adjustment. Remove blade and arm assembly from drive stud. Index blade and arm assembly on drive stud until wiper travel is within windshield glass area.

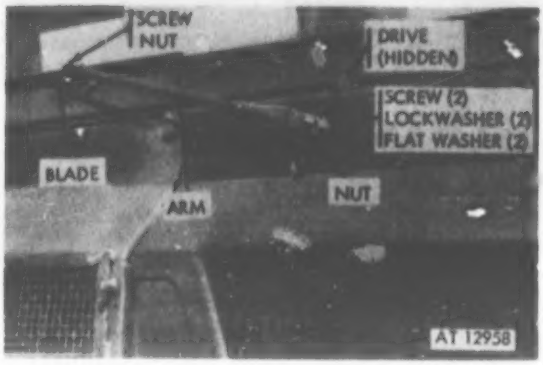


Figure 2-434. Windshield wiper arm and blade, removal and installation.

2-269. Windshield Wiper MOTOR

a. Removal.

(1) Relieve pressure in air system.

(2) Remove arm and blade (para 2-268).

(3) Remove wiper arm drive from motor shaft.

(4) Disconnect two air lines (fig. 2-435).

(5) Remove two screws, lockwashers and flat washers securing motor to cab (fig. 2-434), and remove motor.

b. Installation. Refer to removal procedure and reverse sequence.

c. Adjustment. Remove plug from end of wiper motor cylinder and turn adjusting screw clockwise to lengthen stroke or counterclockwise to shorten stroke if required.

2-270. Windshield Wiper Motor Control, Lines, and Fittings

a. Windshield Wiper Motor Control. Refer to paragraph 2-95 for removal and installation of the wiper motor control.

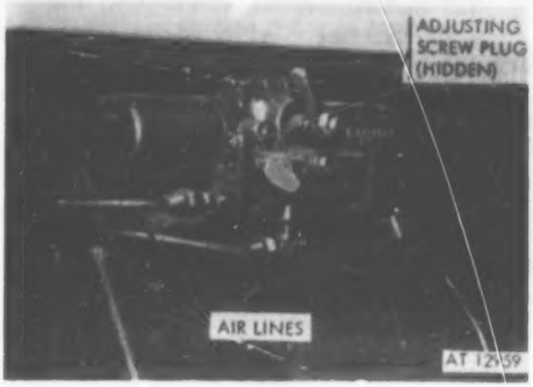


Figure 2-435. Windshield wiper motor, removal and installation.

b. Windshield Wiper Motor Lines and Fittings. Refer to paragraph 2-95 for removal and installation of the lines and fittings.

2-271. Mirrors, Reflectors and Reflector Tapes

a. Mirrors (Fig. 2-436).

(1) *Removal.*

(*a*) Remove nut and flat washer at top and bottom of mirror.

(*b*) Apply upward pressure to upper tab of mirror bracket and remove mirror.

(2) *Installation.* Install mirrors in the reverse order of removal, with flat washer between mirror and tabs of bracket.

(3) *Adjustment.* Refer to TM 9-2320-230-10.

b. Reflectors (XM791).

(1) *Removal.* Remove two screws securing reflector to vehicle, and remove reflector (fig. 2-437).

(2) *Installation.* Position reflector on vehicle and secure with two screws. Refer to figure 2-438 for proper location of reflector color.

c. Reflector Tapes (Fig. 2-439).

(1) *Removal.*

(*a*) Scrape and buff off reflector tape.

(*b*) Clean surface and paint in accordance with TM 9-213.

(2) *Installation.*

(*a*) Surface must be smooth, clean, and dry.

(*b*) Remove backing strips from reflector tape.

(*c*) Position reflector tape on vehicle and apply pressure to insure uniform adhesion. Refer to figure 2-440 for proper location of reflector tape color.

(*d*) Apply sealer 11614197 around edge of reflector.

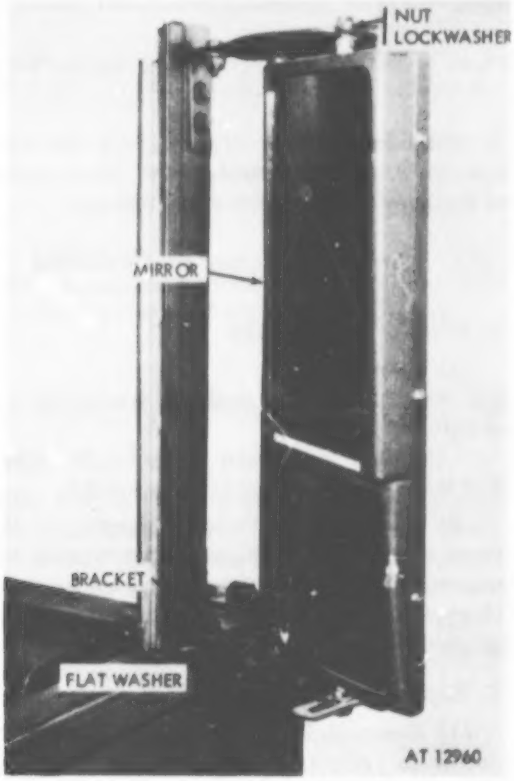


Figure 2-436. Mirrors, removal and installation.

2-272. Bilge Pump Strainer and Outlet Seal

a. Bilge Pump Strainer, Cab Only (Fig. 2-441).

(1) *Removal.*

(*a*) Remove five screws and nuts securing strainer and elbow to floor.

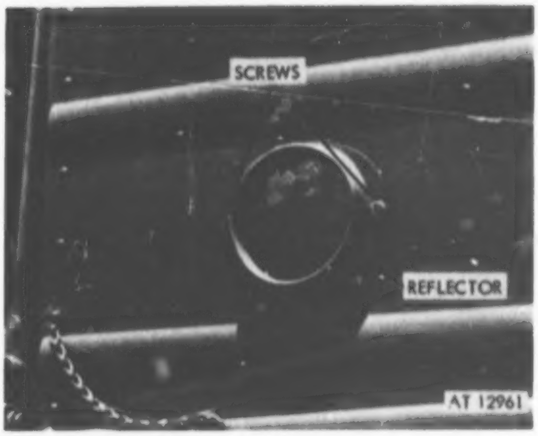


Figure 2-437. Reflectors (XM791), removal and installation.

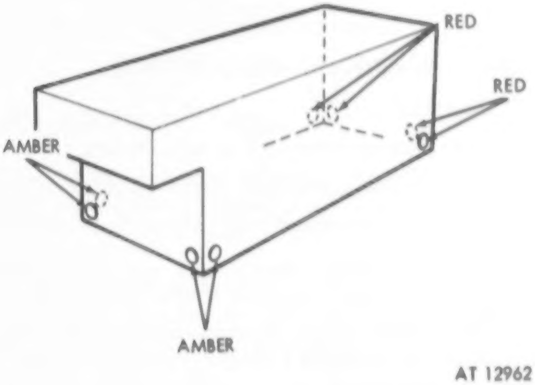


Figure 2-438. Location of reflectors (XM791).

(*b*) Remove strainer and discard the gasket between elbow and underside of cab floor.

(2) *Cleaning, Inspection and Repair.*

(*a*) Clean strainer, and gasket surfaces of bilge pump elbow and cab floor with dry cleaning solvent.

(*b*) Inspect strainer for damage which would restrict drainage or allow foreign materials into bilge pump. Replace damaged strainer.

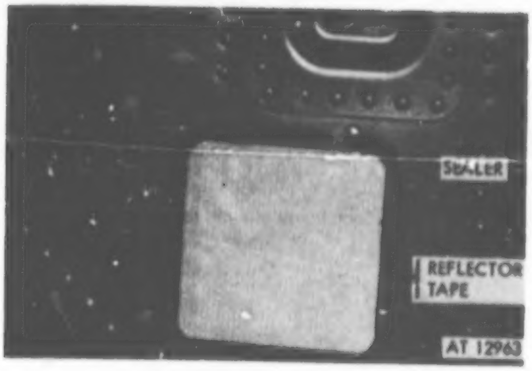

SEALER
REFLECTOR TAPE
AT 12963

Figure 2-439. Reflector tapes, removal and installation.

(3) *Installation.* Using a new gasket, install strainer in reverse order of removal.

b. Bilge Pump Outlet Seal (Fig. 2-442).

(1) *Removal.*

(*a*) Remove clamp securing seal to bilge pump.

(*b*) Slip seal off bilge pump outlet.

(2) *Cleaning, Inspection and Repair.*

(*a*) Remove any seal residue from bilge pump outlet and clean with drycleaning solvent.

(*b*) Replace seal if cracked, torn or punctured.

(3) *Installation.* Install bilge pump outlet seal in reverse order of removal.

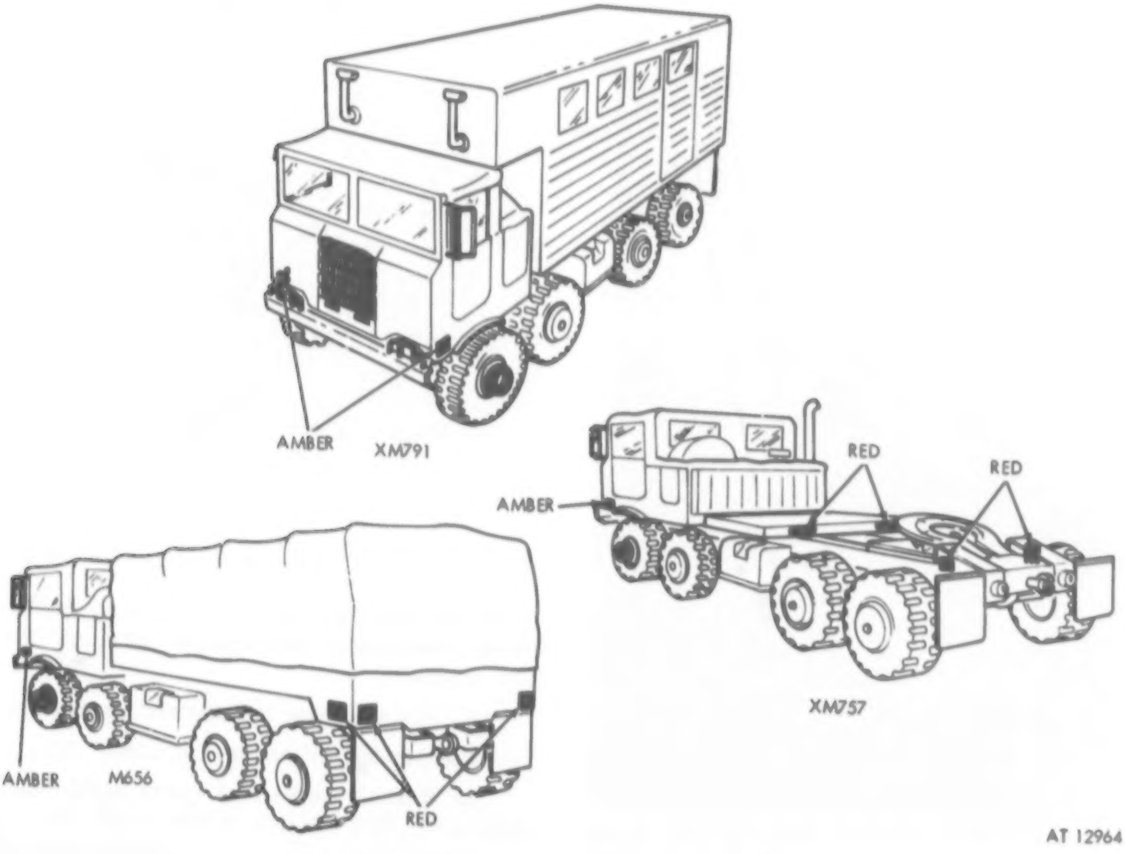

AMBER
XM791
AMBER
RED
RED
XM757
AMBER
M656
RED
AT 12964

Figure 2-440. Location of reflector tapes.

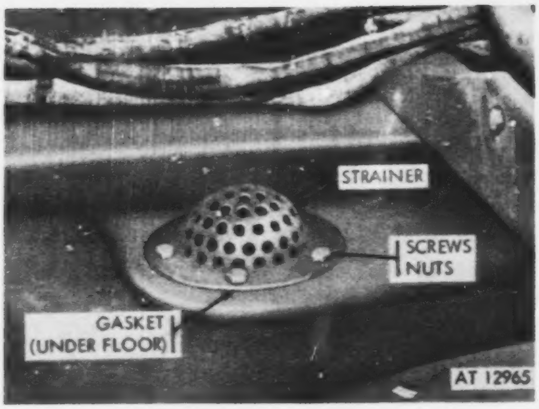

STRAINER
SCREWS
NUTS
GASKET
(UNDER FLOOR)
AT 12965

Figure 2–441. Bilge pump strainer, removal and installation.

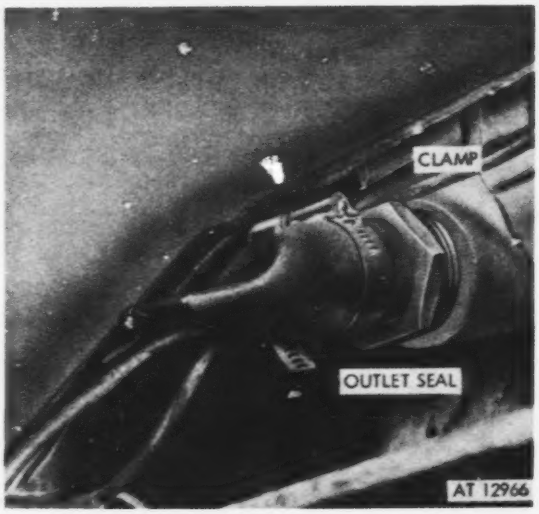

CLAMP
OUTLET SEAL
AT 12966

Figure 2–442. Bilge pump outlet seal removal and installation.

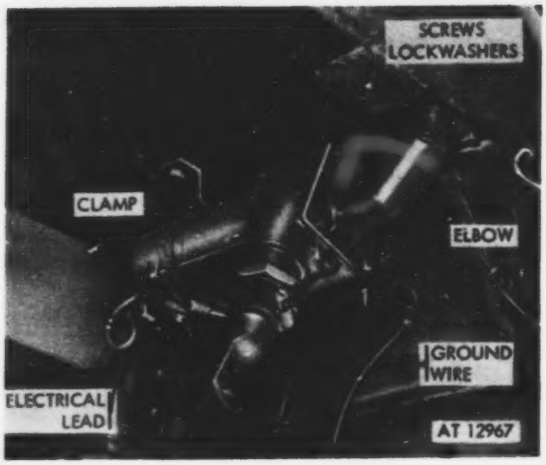

SCREWS
LOCKWASHERS
CLAMP
ELBOW
GROUND
WIRE
ELECTRICAL
LEAD
AT 12967

Figure 2–443. Bilge pump, removal and installation.

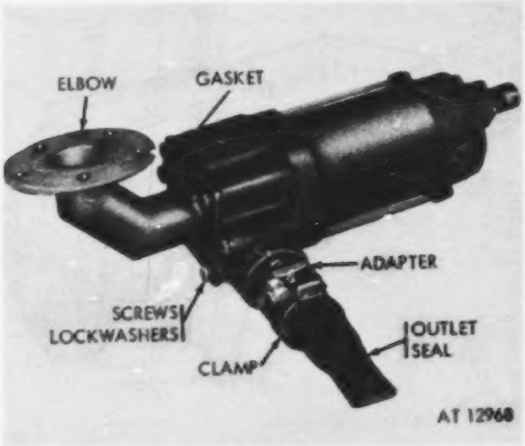

ELBOW
GASKET
ADAPTER
SCREWS
LOCKWASHERS
OUTLET
SEAL
CLAMP
AT 12968

Figure 2–444. Bilge pump, disassembly and assembly.

2–273. Bilge Pump and Brushes

a. Removal (Fig. 2–443).

(1) Disconnect electrical lead and ground.

(2) Remove strainer (para 2–272) of cab bilge pump.

(3) Cargo box bilge pumps are disconnected by removing five screws and lockwashers securing elbow to underside of floor, discard gasket.

(4) Loosen clamp and remove bilge pump.

b. Disassembly (Fig. 2–444).

(1) Remove outlet seal (para 2–272) and adapter.

(2) Remove four screws and lockwashers securing elbow to pump.

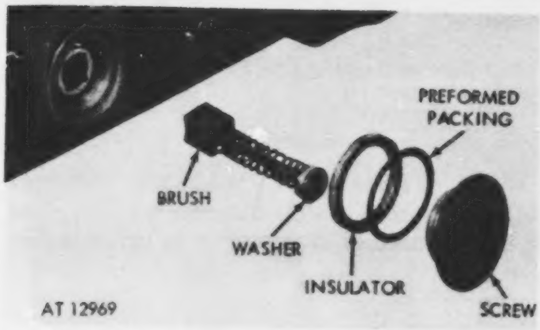

PREFORMED PACKING
BRUSH
WASHER
INSULATOR
SCREW
AT 12969

Figure 2-445. Bilge pump brushes, removal and installation.

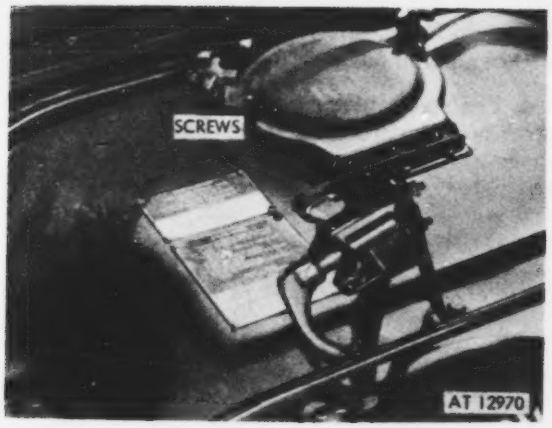

SCREWS
AT 12970

Figure 2-446. Vehicle instruction plate—screw retaining type.

(3) Remove elbow and discard gasket.

(4) Clean pump and remove brush retaining screw, discard preformed packing (fig. 2-445).

(5) Remove insulator, washer and brush assembly.

c. Cleaning, Inspection and Repair.

(1) Clean gasket residue from elbow and pump.

(2) Clean elbow and adapter with drycleaning solvent.

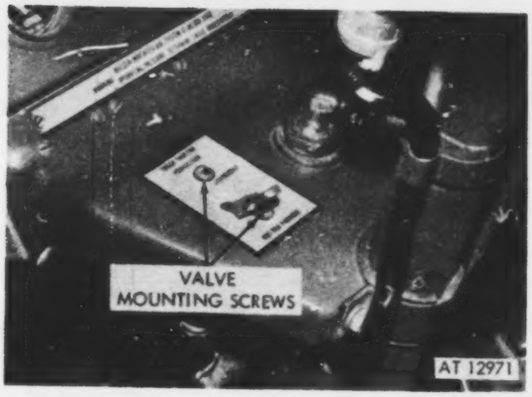

VALVE MOUNTING SCREWS
AT 12971

Figure 2-447. Vehicle instruction plate—valve retaining type.

(3) Inspect brushes. Replace brush assembly when brush is worn one-half of original length, or spring is defective.

(4) Replace preformed packing, insulator and washer when replacing brush. If replacement of brushes will not correct defective pump, replace pump.

d. Assembly and Installation. Assemble and install bilge pump in reverse order of disassembly and removal.

Figure 2-448. Vehicle instruction plate—adhesive type.

best copy available
Reproduced from poor document.

2-274. Vehicle Data and Instruction Plates

a. Screw Retaining Type (Fig. 2-446).

(1) *Removal.* Remove retaining screws and plate.

(2) *Installation.* Position plate on vehicle and secure with self-tapping screws.

b. Component Retaining Type (Fig. 2-447). Removal and installation of plates are accomplished by removal of the retaining component. Refer to the appropriate item removal and installation.

c. Adhesive Type—XM791 (Fig. 2-448).

(1) *Removal.* Peel off plate and remove residue adhesive from vehicle.

(2) *Installation.* Apply adhesive (MIL-A-5092, Type II) to plate, position plate on vehicle and apply pressure to insure adhesion.

Section XXXVII. SPEEDOMETER AND TACHOMETER

2-275. General

This section contains procedures for removal, repair, and installation of the speedometer and tachometer drive shaft assemblies and the speedometer and tachometer adapters. Removal and installation instructions for the speedometer and tachometer are contained in paragraphs 2-277 and 2-278.

2-276. Description

a. The drive systems for speedometer and tachometer consist of upper and lower drive shaft assemblies joined by waterproof bulkhead adapters. The speedometer drive is routed from transfer case to bulkhead adapter, mounted in cab floor, and from adapter to speedometer located in instrument cluster. The tachometer drive is routed from the tachometer 90° drive, located on front of engine, to bulkhead adapter, mounted in engine left bulkhead, and from adapter to tachometer located in instrument cluster.

b. The four drive shaft assemblies (upper and lower assemblies each for speedometer and tachometer) are flexible cables containing a rotating core assembly. The core assembly is protected by a casing assembly composed of an inner nylon liner, a high-tensile wire braid, and a vinyl or polypropylene outer cover. The casing assembly is terminated on each end by threaded nuts and waterproof packing. The core assembly transfers rotational motion from one end of the drive shaft to the other and is constructed of spiral-wound wire with a left-hand lay. One end of the core assembly consists of a keyed drive tip and is the driven end. The other end of the core assembly is square to drive the instrument or the adapter. The lower drive shaft assembly drive tip is supported within a nylon bushing for reduced friction.

c. The speedometer and tachometer adapters provide waterproof seals for passage of drive shafts through cab floor (speedometer) and engine left bulkhead (tachometer).

2-277. Drive Shaft and Adapter Removal

a. Speedometer Drive Shaft Assemblies.

***Caution:* Do not loosen the "O" rings which are on each end of speedometer and tachometer drive shaft assemblies.**

(1) *Upper drive shaft.*

(*a*) Unscrew nut securing upper drive shaft to speedometer and withdraw square end of flexible shaft from speedometer.

(*b*) Unscrew nut securing upper drive shaft to speedometer adapter (fig. 2-449) and withdraw keyed drive tip end of flexible shaft from adapter.

(*c*) Remove speedometer upper drive shaft assembly.

(2) *Lower drive shaft.*

(*a*) Remove and discard four straps securing lower drive shaft to chassis left side rail.

Note. **Mark strap locations for installation.**

(*b*) Unscrew nut securing lower drive shaft to adapter (fig. 2-450) and withdraw square end of flexible shaft from adapter.

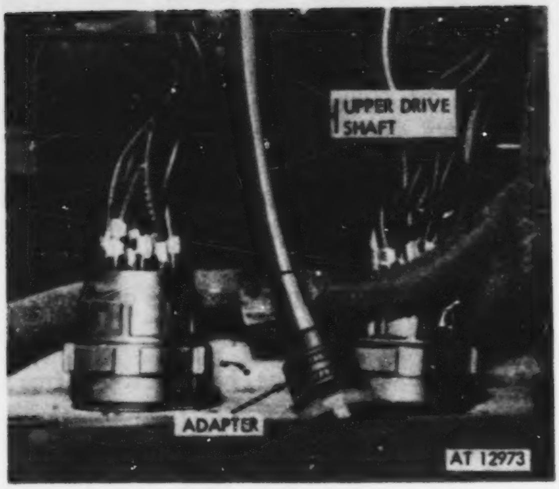

UPPER DRIVE SHAFT
ADAPTER
AT 12973

Figure 2-449. Speedometer upper drive shaft and adapter.

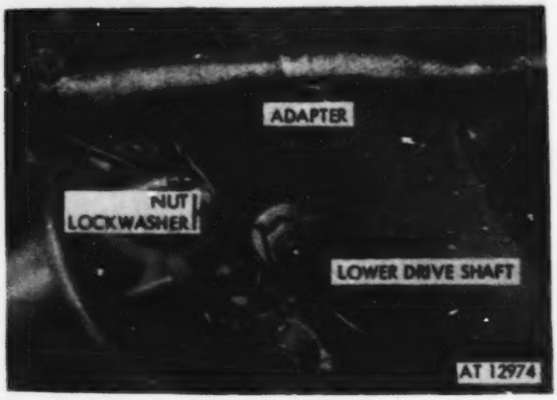

ADAPTER
NUT
LOCKWASHER
LOWER DRIVE SHAFT
AT 12974

Figure 2-450. Speedometer lower drive shaft and adapter.

(*c*) Unscrew nut securing lower drive shaft to speedometer drive on transfer case (fig. 2-451). Withdraw keyed drive tip end of flexible shaft from speedometer drive.

(*d*) Remove speedometer lower drive shaft assembly.

b. Tachometer Drive Shaft Assemblies.

(1) *Upper drive shaft.*

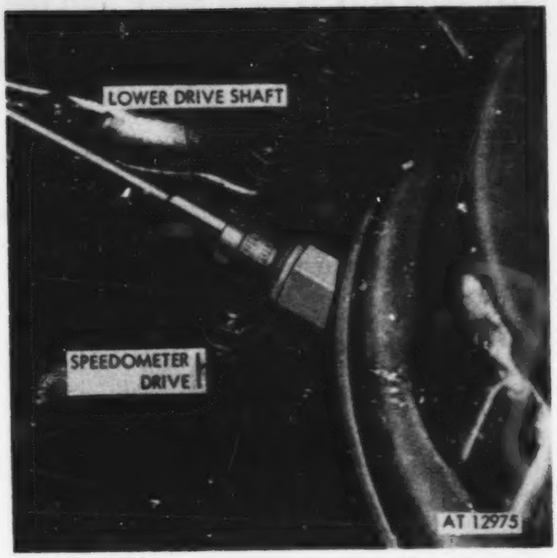

LOWER DRIVE SHAFT
SPEEDOMETER DRIVE
AT 12975

Figure 2-451. Speedometer lower drive shaft and speedometer drive.

(*a*) Unscrew nut securing upper drive shaft to tachometer. Withdraw square end of flexible shaft from tachometer.

(*b*) Unscrew nut securing upper drive

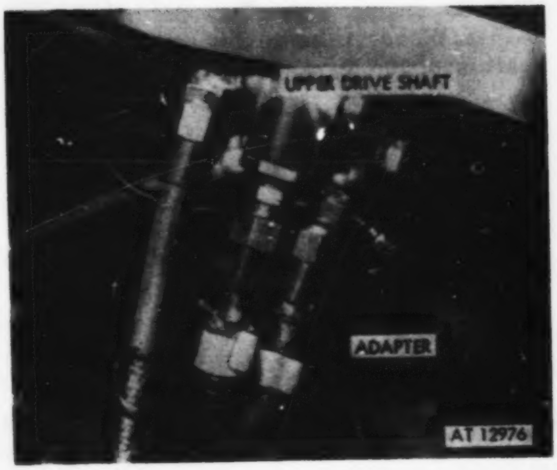

UPPER DRIVE SHAFT
ADAPTER
AT 12976

Figure 2-452. Tachometer upper drive shaft and adapter.

shaft to tachometer adapter (fig. 2-452). Withdraw keyed drive tip end of flexible shaft from adapter.

(*c*) Remove tachometer upper drive shaft assembly.

(2) *Lower drive shaft.*

(*a*) Remove engine hatch covers (para 2-36).

(*b*) Unscrew nut securing lower drive shaft to adapter (fig. 2-453). Withdraw square end of flexible shaft from adapter.

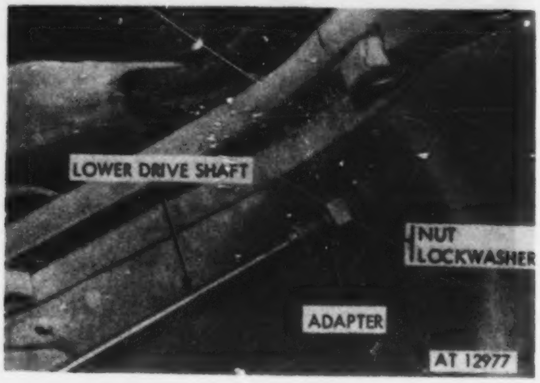


Figure 2-453. Tachometer lower drive shaft and adapter.

(*c*) Unscrew nut securing lower drive shaft to engine tachometer 90° drive (fig. 2-454). Withdraw keyed drive tip end of drive shaft from 90° drive.

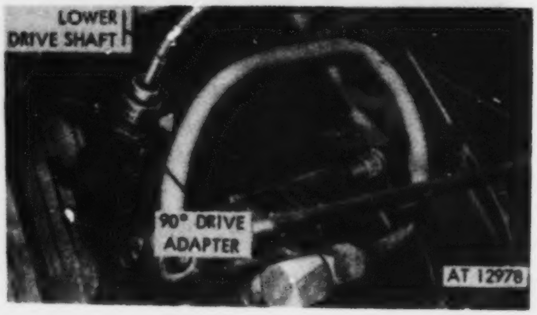


Figure 2-454. Tachometer lower drive shaft and 90° drive.

(*d*) Remove tachometer lower drive shaft.

c. Speedometer Adapter.

(1) Disconnect upper and lower speedometer drive shaft assemblies from adapter (*a* above).

(2) From below cab floor, remove nut and lockwasher securing adapter to floor (fig. 2-450).

(3) Remove adapter from top of cab floor.

d. Tachometer Adapter.

(1) Remove engine hatch covers (para 2-37).

(2) Disconnect tachometer upper and lower drive shaft assemblies from adapter (*b* above).

(3) From inside engine compartment, remove nut and lockwasher securing adapter to engine left bulkhead (fig. 2-453).

(4) Remove adapter from driver's side of engine left bulkhead.

2-278. Disassembly of Drive Shafts and Adapters

a. Drive Shaft Assemblies (Fig. 2-455). Grasp drive tip end of core assembly and withdraw from shaft assembly.

b. Adapters. Remove and discard rubber gasket on adapter body.

2-279. Cleaning, Inspection, and Repair

a. Cleaning. Clean all parts with acceptable cleaning solvent or mineral spirits paint thinner. Insure that threads are free of dirt and grit.

b. Inspection.

(1) Inspect threads for broken threads and cross-threading.

(2) Inspect drive shaft "O" rings for distortion and deterioration.

(3) Inspect bore of casing assembly for obstructions.

(4) Inspect outside of casing assembly for evidence of chafing or other damage.

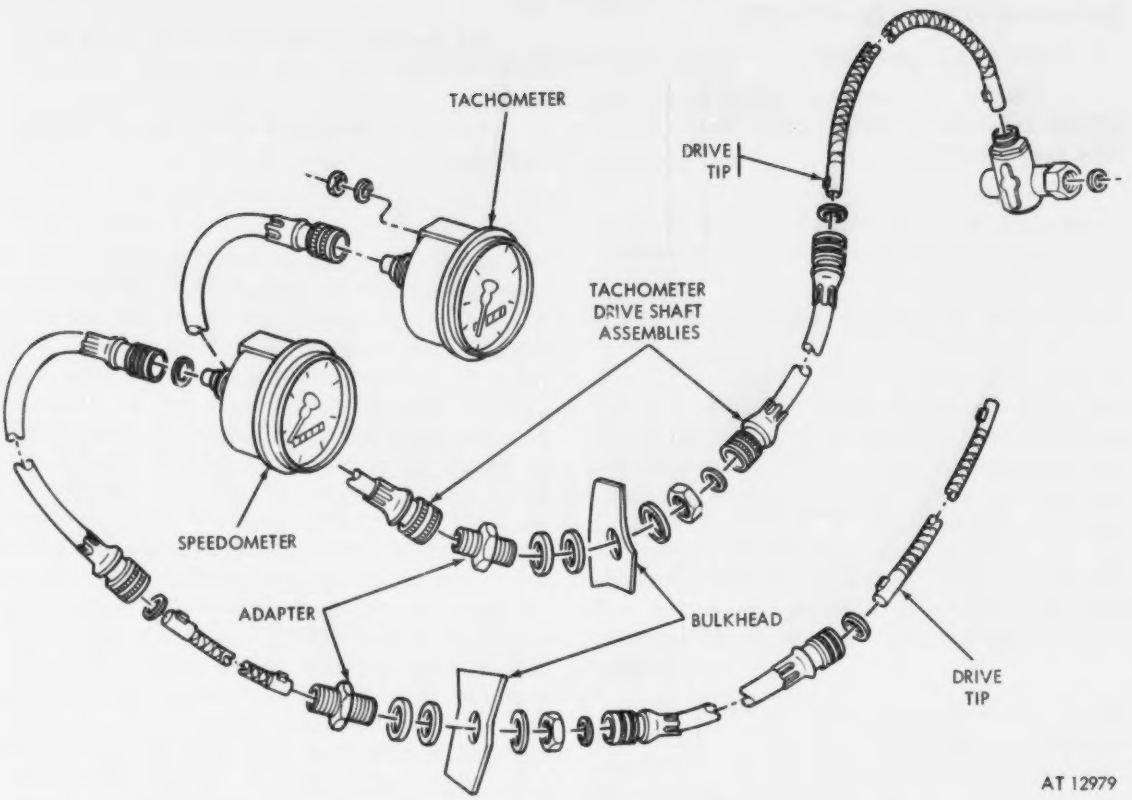

TACHOMETER
DRIVE TIP
TACHOMETER DRIVE SHAFT ASSEMBLIES
SPEEDOMETER
ADAPTER
BULKHEAD
DRIVE TIP
AT 12979

Figure 2-455. Speedometer or tachometer upper or lower drive shaft assemblies.

(5) Check drill quill in bulkhead adapters, engine 90 ° drive, and transfer drive.

(6) Inspect core assembly for broken wire and open lay.

(7) Inspect ends of core assembly for damage. Make sure that drive tip key is not bent or otherwise deformed.

(8) Make sure that adapter core rotates freely.

c. Repair.

(1) Chase damaged threads.

(2) Remove nicks and burs from ends of core assembly using a fine mill file.

2-280. Assembly of Drive Shafts and Adapters

a. Drive Shaft Assemblies (Fig. 2-455).

(1) Apply light coat of MIL-G-23827 grease to core assembly.

(2) Insert square end of core assembly into end of casing assembly having larger diameter nut.

(3) Work core assembly into casing assembly until square end of core assembly appears at end of casing assembly having smaller diameter nut.

b. Adapters. Install new rubber gasket on body of adapter if necessary.

2-281. Installation of Drive Shafts and Adapters

a. Adapters. Refer to removal instructions and reverse sequence (para 2-278).

b. Drive Shaft Assemblies.

(1) Refer to removal instructions and reverse sequence to install drive shaft assemblies (para 2-278).

Note. When positioning drive shafts in vehicle, insure that ends of lower shafts with drive key on at drive units on transfer and engine, and that square ends of upper shafts are at speedometer and tachometer.

(2) Secure speedometer lower shaft to vehicle chassis left side rail with four new straps.

Note. Refer to removal instructions for locations of straps.

CHAPTER 3

SPECIAL PURPOSE KITS

Section I. GENERAL

3-1. Scope

This chapter contains instructions for organizational maintenance of the special purpose kits issued for installation on the 5-ton, 8 x 8, cargo truck M656, tractor truck XM757, and expansible van XM791. Included is a description of the major units of each kit and their functions in relation to the components of the vehicle. Special purpose kits applicable to all models are the winterization kits, cold weather (−25°F.) and artic (−65°F.); the slave kit; slave (Pershing) kit; windshield defogging kit; 100-ampere alternator kit; vehicle slinging kit, and the seat belt kit. Applicable to the M656 and XM757 models only are the machinegun mount kit, the soft top-to-machinegun mount adapter kit, and hardtop-to-machinegun mount adapter kit. The airbrake hand control kit is applicable to the M656 and XM791 models; the cargo bow height extension kit and tailgate support kit are applicable to the M656 model only.

3-2. Maintenance Allocation

The prescribed maintenance responsibilities will apply as shown in the vehicle Maintenance Allocation Chart (refer to appendix B). Any need for cleaning, lubrication, replacement, or repair detected in the equipment beyond the scope of this publication is to be immediately reported to direct support maintenance.

3-3. Service Upon Receipt of Materiel

a. General.

(1) When a vehicle equipped with a new or reconditioned kit is received, it must be determined that the kit has been properly serviced and that all necessary parts are included. Inspect all assemblies, subassemblies and parts for proper installation and condition. If any exterior surfaces are coated with rust-preventive compound, remove with petroleum-based dry-cleaning solvent or mineral spirits paint thinner.

(2) Ordinary deficiencies disclosed during preliminary inspection, servicing, or during installation will be corrected by organizational maintenance personnel.

(3) Serious deficiencies detected in the equipment which occur under the circumstances indicated in TM 38-750 should be immediately reported in accordance with instructions in these regulations.

b. Specific Procedures. For specific procedures, refer to the applicable section within this chapter.

Section II. COLD WEATHER KIT (25° F.)

3-4. Description

This section contains instructions for service and replacement procedures for those components of the cold weather kit which are allocated to organizational maintenance by the Maintenance Allocation Chart. These components are:

a. Multi-Fuel Burning Heater. The heater supplied with the kit is a combustion-type, self-contained unit designed to burn the same fuel as is utilized in the vehicle. The heater is mounted at the rear of the cab.

b. Heater Hoses and Nozzles. From the heater and diverter, air travels into the two hoses and nozzles which provide primary heating of the cab, or into a duct, to defroster hoses and nozzles.

c. Control Box and Emergency Switch. The control box consists of two toggle switches, the HI-LO switch and the RUN-OFF-START switch, and indicator light. The emergency switch, a separate control, removes voltage input to the heater and stops operation immediately. Both are located in the heater control panel on the upper left windshield retainer. Kits for XM 757 vehicles also include a fuel tank selector switch mounted on the control box.

d. Fuel Pump. The fuel pump is a 24-volt, electric type, and is mounted on the frame rail near the fuel tank.

e. Fuel Filter. The filter is located at the rear of the vehicle cab near the heater.

f. Alcohol Vaporizer. The alcohol vaporizer injects alcohol into the air intake to prevent crystallization of moisture in the vehicle air system.

g. Brush Guard Cover. The brush guard cover is attached to the front of radiator brush guard to control airflow through radiator.

h. Slave Kit. A slave kit is included in the cold weather kit. For specific information, see paragraph 3-18.

3-5. Tabulated Data

a. Personnel Heater.

Manufacturer's part number (Benmar)	E 2600
Operating voltage range	20 to 28.5 volts, dc
Current requirement:	
Starting	18.5 amperes
Running	9.5 amperes
Fuel	Hydrocarbon (same as vehicle engine fuel)
Fuel consumption:	
High heat	0.042 lb/min
Low heat	0.026 lb/min
Fuel pressure requirement	3 to 5 psig at fuel valve
Heated air output:	
High heat	30,000 btu/hr
Low heat	14,000 btu/hr
Air delivery	130 cfm

b. Fuel Pump.

Part number	MS51321-2
Operating voltage	24 volts, dc
Current, running	0.4 ampere
Output capacity	25 gph
Output pressure	7 psig

3-6. Service Upon Receipt of Materiel

Material received for maintenance or repair must be checked and serviced as described in paragraph 3-7.

3-7. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed by organizational maintenance personnel to detect and correct defects before major damage or failure results. Any defects or improper operation beyond-scope of organizational maintenance must be reported to direct support maintenance.

b. Table 3-1 lists preventive-maintenance services to be performed or supervised by organizational maintenance personnel.

c. The personnel heater assembly requires no special lubrication.

3-8. Troubleshooting

Table 3-2 is a troubleshooting chart listing malfunctions, probable causes, and corrective measures to be taken by organizational maintenance personnel. The sequence of causes listed in the table is given in the order of their probability and should be considered as such when troubleshooting. If any malfunction is found which is not covered in the troubleshooting chart, notify direct support maintenance.

Table 3-1. Preventive-Maintenance Checks and Services for Cold Weather Kit (−25°F.) Equipped Vehicles

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
1	Control Panel	Place emergency switch in the "ON" position. Depress "press-to-test" indicator lamp on control box to check operational circuit; observe that indicator lamp lights. Set HI-LO switch on personnel heater control box to either HI or LO position. Depress RUN-OFF-START switch to START position and hold until indicator lamp lights. When indicator lamp lights, immediately set RUN-OFF-START switch to RUN position. Do not hesitate in the center OFF position. If heater fails to start, return RUN-OFF-START switch to START and repeat procedure. If after two attempts the heater fails to start, service is required. Check operation of emergency switch.	Para 3-9*d*
2	Heater and Defroster Nozzles	Check defroster duct damper control for adequate windshield defrosting. Check crew heat nozzle door for adequate airflow and heating. (*Note.* Do not open defroster nozzles until cab has been preheated.)	Fig 3-6
3	Fuel System	Check for any leakage from heater fuel lines in cab, heater fuel pump, fuel filter, and vehicle fuel tank connection. Remove and clean, or replace fuel filter element, as required. Remove and clean fuel pump strainer.	Paras 3-9*b*, 3-9*c*, and 3-9*i*.
4	Air Intake and Heater Exhaust	Check fresh-air intake stack and heater exhaust pipe for secure mounting, general condition, and cleanliness. Make sure they are free from obstruction.	Para 3-9*e*
5	Electrical System	Check all electrical cables for secure mounting; check all connectors for good connection with mating connector. Inspect harness for frayed insulation or broken leads; repair or replace as necessary.	Paras 3-9*d* and 3-9*h*
6	Heater	Operate personnel heater and inspect exhaust for excessive smoke. Listen for unusual noises. Replace heater if considered necessary or report conditions noted to direct support maintenance.	Para 3-9*a*
7	Alcohol Evaporator	Refill evaporator bottle with methyl alcohol, O-E-760 (1602). Check air line connections at air governor, cab rear wall, evaporator, engine right bulkhead, and air compressor.	Para 3-9*j*
8	Slave Kit	Check mounting bracket for secure mounting. Check battery terminals for good connections. Inspect cables (including ex-	Para 3-9*l*

Table 3-1. Preventive-Maintenance Checks and Services for Cold Weather Kit (−25°F.) Equipped Vehicles—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
		tension cable) for frayed insulation or broken leads. Repair or replace as necessary.	

Table 3-2. Troubleshooting—Cold Weather Kit (−25°F)

Malfunction	Probable causes	Corrective action
1. Excessive elapsed time before heater ignition.	a. Low battery voltage.	a. Observe battery-generator indicator; if indication is low, check vehicle electrical system and correct low voltage condition.
	b. Defective heater-fuel supply system.	b. Clean fuel filter, as required. Remove and clean fuel pump strainer. If necessary, replace fuel pump.
	c. Defective heater.	c. Replace heater or notify direct support maintenance for repair.
2. Heater fails to ignite. *Caution:* Do not attempt to restart personnel heater if emergency switch has been operated. Notify direct support maintenance.	a. Electrical system failure.	a. Use "press-to-test" feature of indicator lamp on control box to determine if battery voltage is available for operation of heater; check cables, electrical connectors, and control box; repair or replace, as required.
	b. Insufficient or no fuel delivered to heater.	b. Refer to malfunction 8 listed below.
	c. Defective heater.	c. Replace heater or notify direct support maintenance for repair.
3. Heater fails to continue burning.	a. Defective heater.	a. Replace heater or notify direct support maintenance for repair.
	b. Electrical system failure.	b. Use "press-to-test" feature of indicator lamp on control box to determine if battery voltage is available for operation of the heater; check cables, electrical connectors, and control box; repair or replace, as required.
	c. Defective fuel system.	c. Refer to malfunction 8 listed below.
	d. Heater exhaust system restricted; heater overheats and shuts down.	d. Remove restriction from exhaust system or replace exhaust components.
	e. Insufficient air intake to heater to support combustion.	e. Refer to malfunction 9 listed below.
4. Surging combustion sounds during heater operation.	a. Defective regulator valve in heater.	a. Replace heater or notify direct support maintenance for repair.
	b. Defective heater fuel supply.	b. Remove and clean fuel pump strainer and filter element. Operate heater and if trouble continues, replace heater fuel pump.

Table 3-2. Troubleshooting—Cold Weather Kit (−25°F)—Continued

Malfunction	Probable causes	Corrective action
5. Heater exhaust smoking heavily.	*a.* Improper heater combustion.	*a.* Replace heater or notify direct support maintenance for repair.
	b. Defective heater controls.	*b.* Replace control box. Operate heater, and if trouble continues notify direct support maintenance for repair.
	c. Heater exhaust system restricted; heater overheating and noisy.	*c.* Remove restriction from exhaust system or replace exhaust components, as necessary.
	d. Defective heater.	*d.* Replace heater or notify direct support maintenance for repair.
6. Heater output is low. (HI-LO switch set on HI position.)	*a.* HI-LO switch on control box open or defective.	*a.* Replace heater control box or notify direct support maintenance for repair.
	b. Defective fuel system.	*b.* Refer to malfunction 8 listed below.
	c. Defective heater.	*c.* Replace heater or notify direct support maintenance for repair.
7. Fuel odor within cab.	*a.* Leaking fuel at heater fuel line connection.	*a.* Tighten or replace connection, as necessary. Examine all fuel lines and fuel filter within vehicle cab for leakage.
	b. Defective heater.	*b.* Replace heater or notify direct support maintenance for repair.
8. Insufficient or no fuel delivered to heater (fuel tank full).	*a.* Fuel filter restricted.	*a.* Remove and clean or replace fuel filter element, as required.
	b. Fuel pump strainer restricted.	*b.* Remove and clean fuel pump strainer.
	c. Fuel pump not operating; no voltage at electrical connector.	*c.* Check for voltage at fuel pump connector. If voltage present, replace fuel pump; if no voltage present, check cables for loose or defective wiring.
	d. Leaking or restricted fuel line.	*d.* Tighten or remove and replace fuel line, as necessary.
9. Insufficient or no air intake to heater to support combustion.	*a.* Restriction in heater air intake.	*a.* Remove restriction.
	b. Defective heater blower motor.	*b.* Replace heater or notify direct support maintenance for repair.
10. Windshield defrosters not operating.	*a.* Defroster duct damper control not actuated.	*a.* Set damper control to defrost windshields; check for warm air output at both nozzles.
	b. Defroster ducts restricted; disconnected, crushed or damaged ducts.	*b.* Clear defroster ducts of any restriction; repair or replace ducts, as required.
11. Evaporator system not operating.	*a.* Insufficient alcohol in alcohol bottle.	*a.* Replenish alcohol supply with methyl alcohol, O-E-760 (1620).
	b. Restriction in evaporator lines, check valves, or venturi.	*b.* Clear restriction.
	c. Broken or leaking evaporator lines, check valves, or venturi.	*c.* Tighten loose connections. Replace broken lines or components.
12. Alcohol odor in cab.	*a.* Broken or leaking alcohol evaporator bottle.	*a.* Tighten loose connection between evaporator bottle and bottle cap. Replace broken evaporator bottle.

Table 3-2. Troubleshooting—Cold Weather Kit (−25°F.)—Continued

Malfunction	Probable causes	Corrective action
	b. Broken air line from evaporator bottle to air compressor or air induction system.	*b.* Replace broken air lines.

3-9. Maintenance Instructions for Replacement of Cold Weather Kit Components

a. Heater Assembly and Diverter Assembly (Fig. 3-1).

(1) *Removal.*

(*a*) Disconnect the electrical cable at heater receptacle.

(*b*) Loosen pipe clamp and disconnect exhaust pipe at heater.

(*c*) Disconnect fuel line at heater fuel inlet.

(*d*) Loosen clamps and remove hoses to heater diverter.

(*e*) Loosen clamp and remove air intake adapter on heater.

(*f*) Remove two screws and lockwashers from diverter flange.

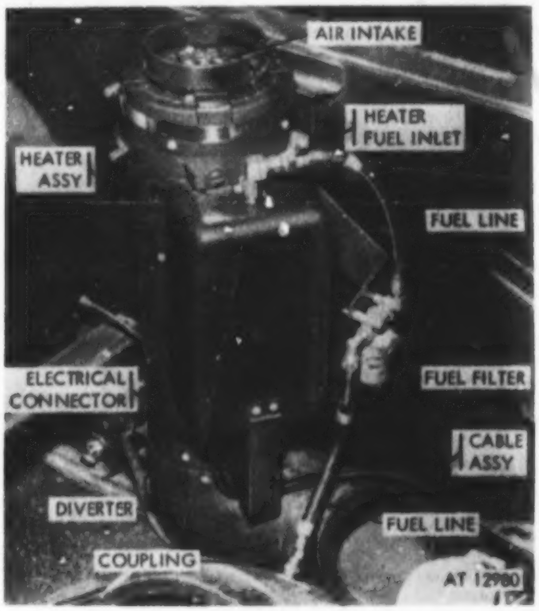


Figure 3-1. Heater assembly, diverter, and fuel filter.

(*g*) Remove two heater mounting straps retaining heater to bracket.

(*h*) Remove heater and diverter.

(*i*) Remove four screws and lockwashers joining diverter and heater.

(*j*) Remove diverter from heater.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Fuel Pump (Figs. 3-2 and 3-3).

(1) *Removal.*

(*a*) Disconnect fuel line from inlet port of fuel pump.

(*b*) (*XM757 only*). Disconnect fuel lines from inlet ports of solenoid valve.

(*c*) (*XM757 only*). Remove fuel inlet line from lower port of fuel pump and from outlet of solenoid valve.

(*d*) Disconnect line from outlet port of fuel pump.

(*e*) Disconnect pump electrical lead from harness.

(*f*) Remove pump from bracket assembly by removing two screws, lockwashers, and nuts.

(2) *Installation.* Refer to removal procedure and reverse sequence.

c. Fuel Filter (Fig. 3-1).

(1) *Removal.*

(*a*) Disconnect fuel lines at fuel filter.

(*b*) Remove two nuts, lockwashers, flat washers, and screws securing filter to mounting bracket and remove filter.

(2) *Installation.* Refer to removal procedure and reverse sequence.

d. Heater Control Panel (Fig. 3-4).

(1) *Removal.*

(*a*) Remove three capscrews, lockwashers and nuts, and four flat washers securing control panel to top of windshield. Remove control panel.

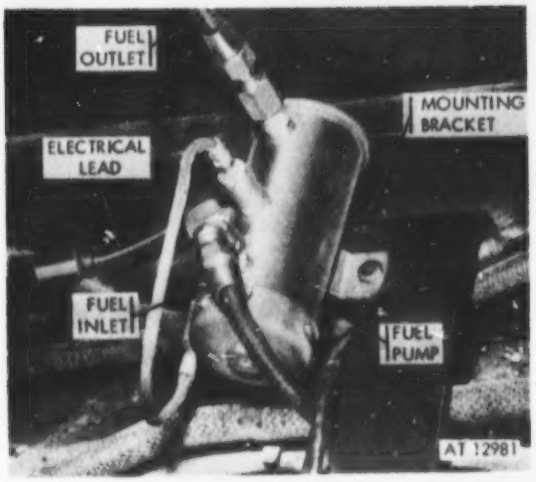

FUEL OUTLET
MOUNTING BRACKET
ELECTRICAL LEAD
FUEL INLET
FUEL PUMP
AT 12981

Figure 3-2. Fuel pump, fuel lines, and electrical lead.

(*b*) Disconnect five electrical connectors from behind and under control panel.

(*c*) Disconnect ground lead from top of control panel.

(*d*) Disconnect two connectors from behind fuel tank selector switch and slide leads and grommet out of slot in selector switch bracket (XM757).

(*e*) Remove capscrew, two flat washers, lockwasher, nut, and clamp securing electrical harness to upper left side of windshield.

(*f*) Remove harness assembly from control panel by sliding harness and grommet out of slot in left side of control panel bracket.

(2) *Installation.* Refer to removal procedure and reverse sequence.

e Heater Exhaust System (Fig. 3-5).

(1) *Removal.*

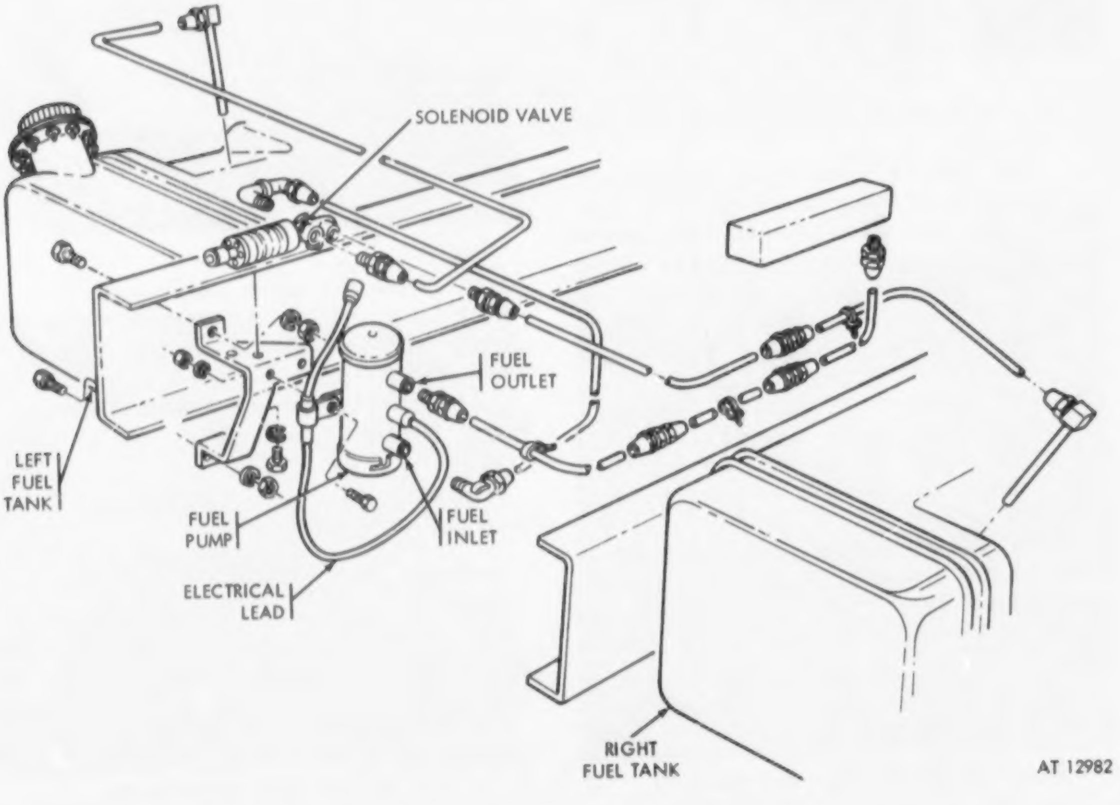

SOLENOID VALVE
FUEL OUTLET
LEFT FUEL TANK
FUEL PUMP
FUEL INLET
ELECTRICAL LEAD
RIGHT FUEL TANK
AT 12982

Figure 3-3. Fuel pump, fuel lines, and electrical lead (XM757).

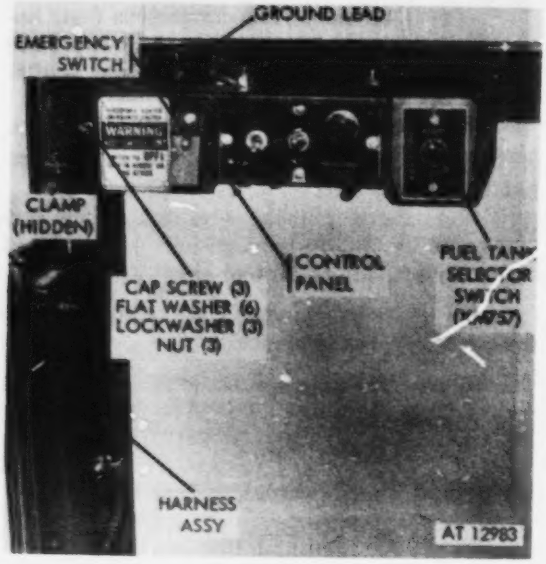

GROUND LEAD
EMERGENCY SWITCH
CLAMP (HIDDEN)
CONTROL PANEL
FUEL TANK SELECTOR SWITCH
CAP SCREW (3)
FLAT WASHER (6)
LOCKWASHER (3)
NUT (3)
HARNESS ASSY
AT 12983

Figure 3-4. Heater control panel and related parts.

(*a*) Remove three nuts, lockwashers, and capscrews securing clamps to heater upper exhaust pipe and vehicle exhaust pipe. Remove two clamps.

(*b*) Remove two nuts, lockwashers, and capscrews securing upper exhaust pipe to center exhaust pipe. Remove upper exhaust pipe and gasket. Discard gasket.

(*c*) Remove two capscrews and lockwashers securing center exhaust pipe to cab right rear corner gusset and lower exhaust pipe. Remove center exhaust pipe and gasket. Discard gasket.

(*d*) Loosen clamp securing lower end of lower exhaust pipe to heater assembly. Remove lower exhaust pipe, clamp and gasket. Discard gasket. Separate clamp from lower exhaust pipe.

(2) *Installation.* Refer to removal procedure and reverse sequence.

f. Defroster Hoses (Figs. 3-6 and 3-7).

(1) *Removal.*

(*a*) Loosen two clamps and remove defroster input hose at diverter outlet (fig. 3-7) and at duct inlet (fig. 3-6).

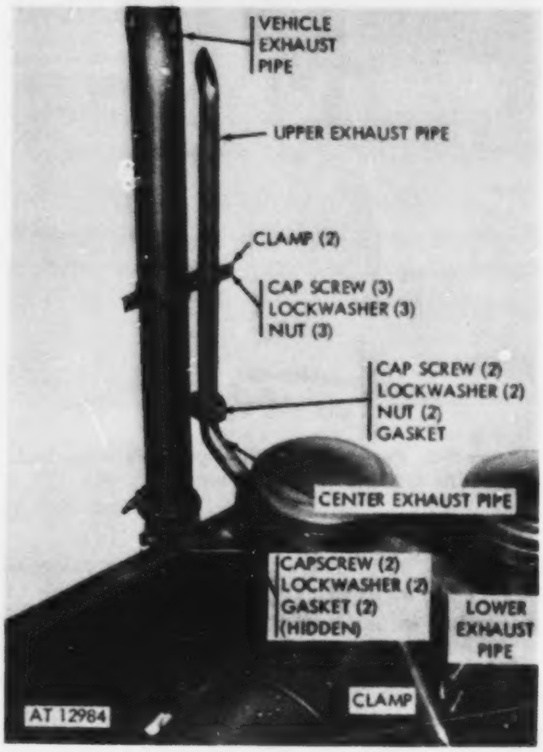

VEHICLE EXHAUST PIPE
UPPER EXHAUST PIPE
CLAMP (2)
CAP SCREW (3)
LOCKWASHER (3)
NUT (3)
CAP SCREW (2)
LOCKWASHER (2)
NUT (2)
GASKET
CENTER EXHAUST PIPE
CAPSCREW (2)
LOCKWASHER (2)
GASKET (2)
(HIDDEN)
LOWER EXHAUST PIPE
CLAMP
AT 12984

Figure 3-5. Heater exhaust system.

(*b*) Loosen two clamps and remove two hoses from defroster duct outlet and nozzles (fig. 3-6).

(2) *Installation.* Refer to removal procedure and reverse sequence.

g. Heater Hoses (Figs. 3-7 and 3-8).

(1) *Removal.*

(*a*) Loosen two clamps on each heater hose at diverter (fig. 3-7) and at nozzle (fig. 3-8).

(*b*) Remove retainer strap on heater hose on driver's side.

(*c*) Remove both heater hoses.

(2) *Installation.* Refer to removal procedure and reverse sequence.

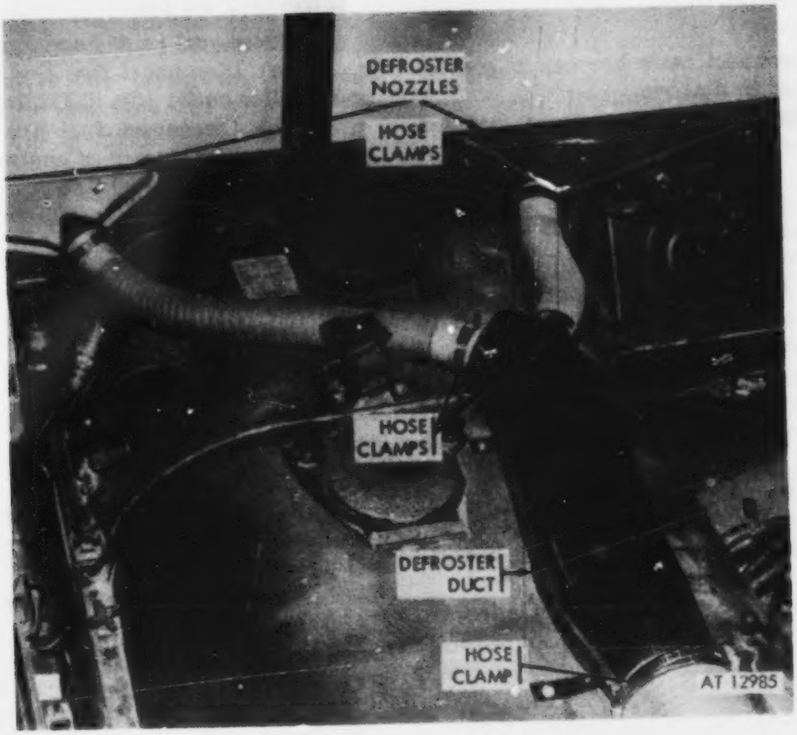

DEFROSTER NOZZLES
HOSE CLAMPS
HOSE CLAMPS
DEFROSTER DUCT
HOSE CLAMP
AT 12985

Figure 3-6. Defroster hose connections.

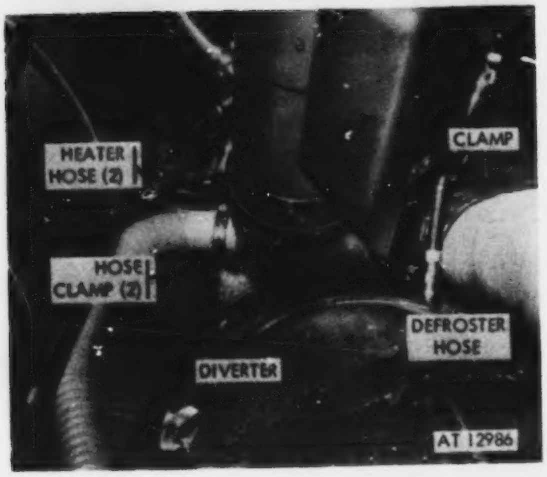

HEATER HOSE (2)
CLAMP
HOSE CLAMP (2)
DEFROSTER HOSE
DIVERTER
AT 12986

Figure 3-7. Defroster and heater hose connections at diverter outlet.

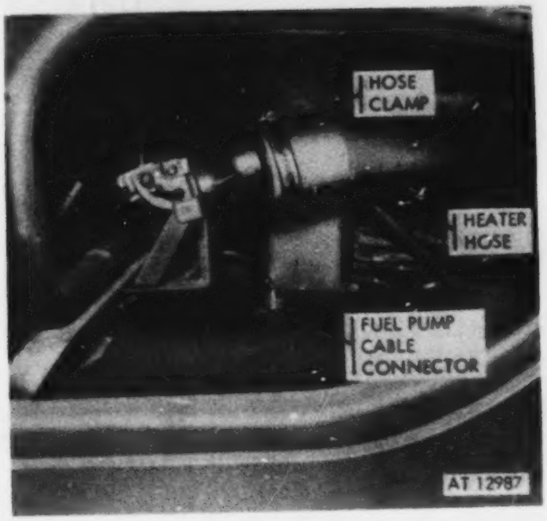

HOSE CLAMP
HEATER HOSE
FUEL PUMP CABLE CONNECTOR
AT 12987

Figure 3-8. Heater hose connections, driver's side (typical).

h. Cable Harness.

(1) *Removal.*

(*a*) Disconnect cable harness at control panel as directed in *d* above.

(*b*) Disconnect heater front harness from heater rear harness. Remove front harness.

(*c*) Disconnect circuit 10 connector from circuit breaker (fig. 3-9).

(*d*) Disconnect horn circuit 10 from heater harness and connect to circuit breaker.

(*e*) Disconnect harness ground lead from low air warning indicator.

(*f*) Remove four machine screws, lockwashers and nuts and disconnect heater rear harness from fuel pump cable connector in cab floor (fig. 3-8).

(*g*) Remove five clamps and nine straps securing heater rear harness to engine compartment sidewall and driver's side heater hose.

(*h*) Disconnect heater rear harness from heater. Remove rear harness.

(*i*) Disconnect fuel pump cable at fuel pump (fig. 3-2).

(*j*) Remove straps securing fuel pump cable to speedometer cable. Remove fuel pump cable.

(2) *Installation.* Refer to removal procedure and reverse sequence.

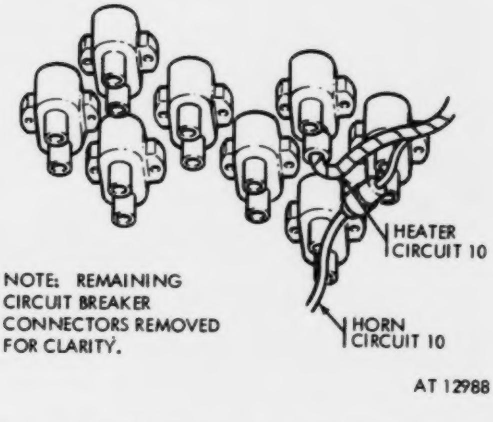

HEATER CIRCUIT 10
NOTE: REMAINING CIRCUIT BREAKER CONNECTORS REMOVED FOR CLARITY.
HORN CIRCUIT 10
AT 12988

Figure 3-9. Heater circuit breaker connections.

i. Heater Fuel Lines.

(1) *Removal (M656 and XM791).*

(*a*) Disconnect fuel line at heater inlet and at filter outlet (fig. 3-1). Remove fuel line.

(*b*) Disconnect fuel line at filter inlet and at coupling at rear of engine compartment (fig. 3-1). Remove fuel line.

(*c*) Disconnect fuel line at coupling inside engine compartment and fuel manifold on frame left side rail. Remove fuel line.

(*d*) Disconnect fuel line at fuel manifold and fuel pump outlet (fig. 3-2). Remove fuel line.

(*e*) Disconnect fuel line at fuel pump inlet (fig. 3-2) and at fuel tank. Remove fuel line.

(2) *Removal (XM757) (fig. 3-3).*

(*a*) Remove fuel lines from heater to fuel pump as directed in g(1) above.

(*b*) Disconnect fuel line at fuel pump inlet and solenoid valve. Remove fuel line.

(*c*) Disconnect fuel line from solenoid valve to right fuel tank. Remove fuel line.

(*d*) Disconnect fuel line from solenoid valve to right fuel tank. Remove fuel line.

(3) *Installation.* Refer to removal procedure and reverse sequence.

j. Alcohol Vaporizer Lines and Fittings (Figs. 3-10 and 3-11).

(1) *Removal.*

Note. Key numbers in parentheses refer to figure 3-10.

(*a*) Remove evaporator (9).

(*b*) Disconnect tube assembly (5) at elbow (4).

(*c*) Disconnect tube assembly (11) at adapter (12).

(*d*) Remove three capscrews (6), six flat washers, three lockwashers, and three nuts securing cap assembly (8) to engine compartment (20).

(*e*) Remove cap assembly (8), with attached parts, and gasket (6). Discard gasket.

(*f*) Remove tube assembly (5), elbow (7), tube assembly (11), and adapter (10) from cap assembly (8).

(*g*) Disconnect tube assembly (16) from tee (14).

(*h*) Loosen two clamps (18) and remove hose assembly (17).

(*i*) Remove two capscrews, flat washers, lockwashers, and nuts (2) securing venturi assembly (1) to engine compartment right sidewall.

(*j*) Remove venturi assembly (1) and gasket (2). Discard gasket.

(*k*) Remove elbow (4), check valve (3), adapter (19), tube assembly (15), tee (14), check valve (13), and adapter (12) from venturi assembly (1).

(*l*) Loosen nut securing tube assembly and elbow to cab rear bulkhead (fig. 3–11). Disconnect and remove tube assembly and gasket. Discard gasket. Remove elbow from tube assembly.

(*m*) Disconnect hose assembly from adapter on air governor (fig. 3–12). Remove adapter.

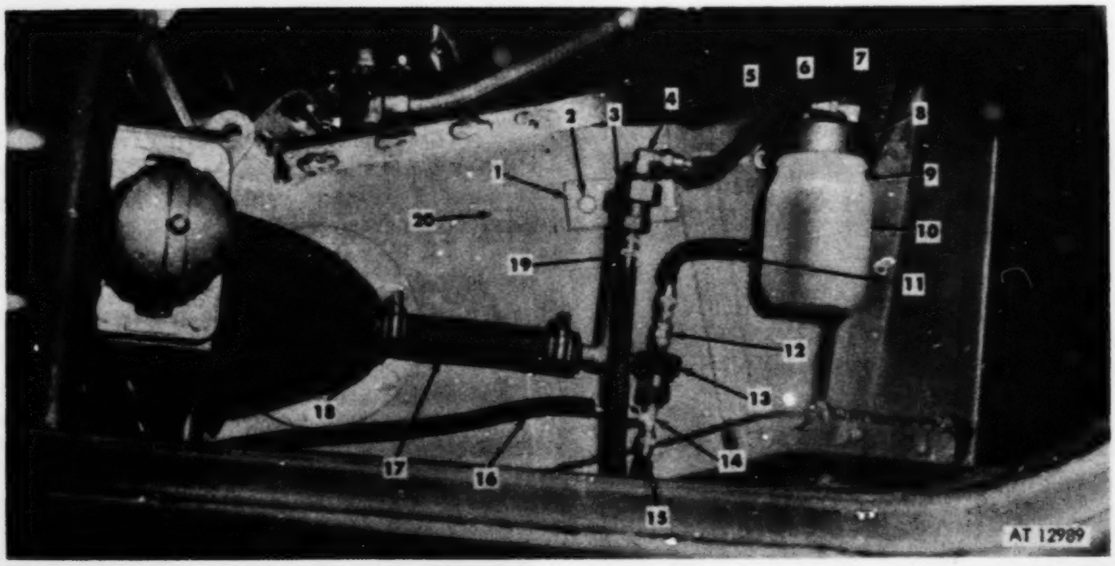
(*n*) Remove hose assembly, two flat washers, and adapter from cab outside rear bulkhead.

(2) *Installation.* Refer to removal procedure and reverse sequence.

Note. Apply sealing compound (MIL–S–45180, type II) to pipe threads of tube fittings prior to assembly.

k. Brush Guard Cover (Fig. 3–13).

(1) *Removal.* Turn heads of 11 snap fastners to aline with eyes of brush guard cover and pull cover away from brush guard. Remove fastners from brush guard.



1—Venturi assembly
2—Capscrew (2)
  Flat washer (2)
  Lockwasher (2)
  Nut (2)
  Gasket
3—Check valve
4—Elbow
5—Tube assembly
6—Capscrew (3)
  Flat washer (6)
  Lockwasher (6)
  Nut (3)
  Gasket
7—Elbow
8—Cap assembly
9—Evaporator
10—Adapter (hidden)
11—Tube assembly
12—Adapter
13—Check valve
14—Tee
15—Tube assembly
16—Hose assembly
17—Tube assembly
18—Clamp (2)
19—Adapter
20—Engine compartment

Figure 3–10. Alcohol evaporator and venturi assembly.

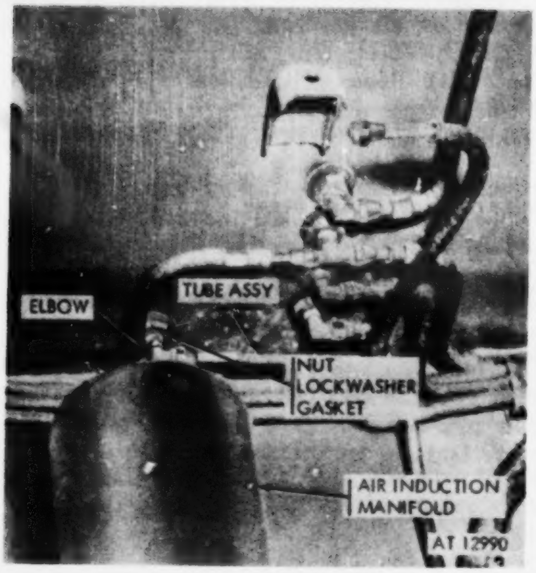

TUBE ASSY
ELBOW
NUT
LOCKWASHER
GASKET
AIR INDUCTION
MANIFOLD
AT 12990

Figure 3-11. Alcohol vaporizer connection to cab inside rear bulkhead.

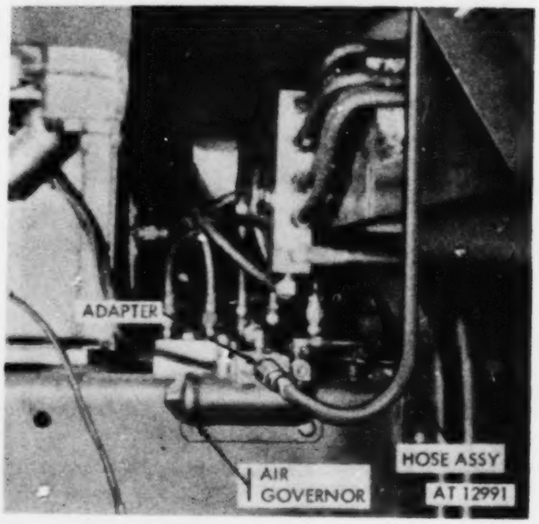

ADAPTER
HOSE ASSY
AIR
GOVERNOR
AT 12991

Figure 3-12. Alcohol vaporizer connections to air governor and cab outside rear bulkhead.

(2) *Installation.* Install 11 snap fastners into existing holes of brush guard. Place brush guard cover over brush guard and place eyes of cover over snap fastners. Turn heads of snap fastners to secure cover in place.

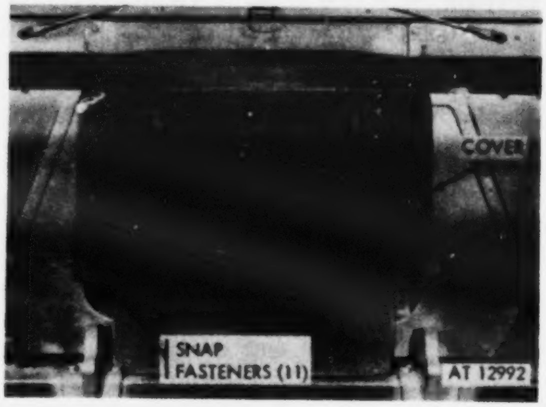

COVER
SNAP
FASTENERS (11)
AT 12992

Figure 3-13. Brush guard cover, installed view.

l. Slave Kit (Fig. 3-14).

(1) *Removal.*

(*a*) Open battery box cover.

(*b*) Remove nut securing vehicle and slave kit negative cables to negative battery terminal. Disconnect vehicle and slave kit negative cables from battery.

(*c*) Repeat operation (*b*) above for positive cables.

(*d*) Reconnect vehicle positive cable to battery positive terminal and secure with nut.

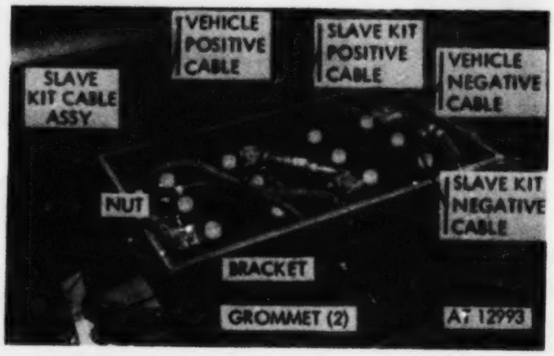

VEHICLE
POSITIVE
CABLE
SLAVE KIT
POSITIVE
CABLE
VEHICLE
NEGATIVE
CABLE
SLAVE
KIT CABLE
ASSY
NUT
SLAVE KIT
NEGATIVE
CABLE
BRACKET
GROMMET (2)
AT 12993

Figure 3-14. Slave kit, installed view.

(*e*) Repeat operation (*d*) above for vehicle negative cable.

(*f*) Remove four nuts, four lockwashers, six flat washers, and four capscrews securing slave kit cable assembly and bracket to front of battery box. Remove cable assembly and bracket, pulling cales through grommets in front of battery box.

(*g*) Remove two grommets from front of battery box.

(*h*) Remove six nuts, six lockwashers, 12 flat washers and six capscrews securing cable assembly receptacle to bracket. Separate bracket and cable assembly.

(2) *Installation.* Refer to removal procedure and reverse sequence.

3-10. Parts List

The spare parts of the cold weather kit (−25°F.), shown in figures 3-1 through 3-14, allocated for replacement by organizational maintenance are listed in TM 9-2320-230-20P.

Section III. ARCTIC KIT (−65° F.)

3-11. Description

a. General. This section contains service and replacement procedures for those components of the arctic kit (−65°F.) which are allocated to organizational maintenance personnel. The complete arctic kit contains the items described below in addition to all of the items of the cold weather kit (−25°F.). An explanation of components common to both arctic and cold weather kits will be found in section II.

b. Fuel Burning Coolant Heater. The combustion-type engine coolant heater, located to the right of the engine compartment, is a self-contained unit which burns the same fuel as the vehicle. The coolant heater warms engine coolant which is circulated through the engine and a tray in the battery box.

c. Coolant Heater Control Box. The coolant heater control box is located with the personnel heater control box and emergency switch on the heater control panel at top left of windshield.

d. Coolant Pump. The coolant pump is mounted on the cab floor at rear of passenger seat. It is a centrifugal type, driven by a 24-volt electric motor.

e. Oil Pan Shroud. Exhaust from coolant heater is routed to a shroud mounted on oil pan to warm engine oil.

f. Cab Hardtop. A fully insulated cab hardtop is provided to replace the cab soft top.

g. Insulation. The interior surfaces of the cab, including engine hatch covers, are covered with arctic type thermal barrier insulation.

3-12. Tabulated Data

a. Coolant Heater.

Part number	10914540
Operating voltage range	18 to 28 volts, dc
Current requirement:	
Starting	11 amperes
Running	1 ampere
Fuel	Hydrocarbon (same as vehicle engine fuel)
Fuel consumption:	
High heat	0.026 lb/min
Low heat	0.011 lb/min
Fuel pressure requirement	1 to 15 psig at fuel valve
Coolant heater output:	
High heat	16,000 btu/hr
Low heat	5,500 btu/hr
Exhaust output:	
High heat	8,000 btu/hr
Low heat	4,500 btu/hr

b. Coolant Pump Motor.

Part number	10946835
Operating voltage	24 volts, dc
Current, running	2 amperes
Motor speed	3400 rpm

3-13. Service Upon Receipt of Materiel

Material received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-14.

3-14. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed by the operator or crew in order that defects may be detected and corrected before damage or failure results. Any defects or imporper operation beyond the scope of the operator or organizational maintenance personnel must be reported to direct support maintenance.

b. Table 3-3 lists preventive-maintenance services to be performed or supervised by organizational maintenance personnel.

Table 3-3. Preventive-Maintenance Checks and Services for Arctic Kit (−65°F.) Equipped Vehicles

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
1	Control Panel	Check "press-to-test" feature of indicator lamp on coolant control box.	Para 3-16*n*
2	Coolant Circulating System	Check for any coolant leakage from coolant heating system at engine shutoff cocks, bulkhead connectors, battery box tray, coolant pump and coolant heater, be sure shutoff cocks are open.	Para 3-16*i*, 3-16*j* and 316*k*
3	Coolant Heater	Listen for unusual sounds when coolant heater is in use. Observe coolant heater exhaust at oil pan shroud for presence of excessive smoke.	Para 3-16*h*
4	Insulation	Check for missing, torn or damaged polyvinyl insulation in cab interior; repair or replace, as necessary.	Para 3-11*g*
5	Brush Guard Cover	Check brush guard cover for damaged or missing fasteners or tears in fabric; repair as necessary.	Para 3-9*k*
6	Hardtop	See item 4 above.	Para 3-11*f*

Note. Also see table 3-1.

3-15. Troubleshooting

The troubleshooting information given in table 3-4 refers to the coolant heater and circulating pump only unless otherwise noted. Refer to section II, paragraph 3-8 for troubleshooting the personnel heater and malfunctions common to both heaters. The sequence of probable causes listed in the table is given in the order of probability and should be considered as such when troubleshooting. In the event that any malfunction occurs which is not covered in the troubleshooting information given in the table, notify direct support maintenance personnel.

Table 3-4. Troubleshooting—Arctic Kit (−65°F.) Coolant Heater

Malfunction	Probable causes	Corrective action
1. Engine oil pan shroud not receiving heat.	*a.* Coolant heater not operating.	*a.* Start coolant heater; if coolant heater does not start, or fails to continued burning, refer to malfunction 2 or 3, table 3-2.
	b. Coolant heater exhaust pipe loose, disconnected, or broken.	*b.* Check and secure exhaust pipe; replace exhaust pipe if necessary.
	c. Coolant heater exhaust pipe restricted.	*c.* Clear exhaust pipe of any restrictions.
2. Engine coolant not receiving heat.	*a.* Coolant heater not operating.	*a.* Start coolant heater; if coolant heater does not start, or fails to continue burning, refer to malfunction 2 or 3, table 3-2.

Table 3-4. Troubleshooting—Artic Kit (-65°F.) Coolant Heater—Continued

Malfunction	Probable causes	Corrective action
	b. One or both coolant shutoff cocks closed at engine block or water manifold.	*b.* Open coolant shutoff cocks.
	c. Restriction in coolant heater hose, fittings, coolant pump, or battery box tray.	*c.* Clean hose or replace hose, as required. Clean out fittings or replace, as required. Flush out coolant pump and battery box tray; replace if required.
	d. Coolant pump not operating.	*d.* Check for voltage at coolant pump motor. If voltage present, replace coolant pump. If no voltage is present, check cables for loose or defective wiring.
3. Battery box tray not receiving adequate heat.	*a.* Coolant heater not operating.	*a.* Start coolant heater; if coolant heater does not start or continue burning, refer to malfunction 2 or 3, table 3-2.
	b. One or both coolant shutoff cocks closed at engine block or water manifold.	*b.* Open coolant shutoff cock.
	c. Restriction in coolant heater hose, fittings, coolant pump, or battery box tray.	*c.* Clear restriction from heater hose, fittings, coolant pump, or battery box tray.
	d. Coolant pump not operating.	*d.* Refer to corrective action item 2d above.

3-16. Maintenance Instructions for Replacement of Arctic Kit (-65° F.) Components

a. General. The following instructions pertain to removal and installation of components of the arctic kit which are not components of the cold weather kit and are allocated to organizational maintenance personnel. Refer to paragraph 3-9 for replacement instructions for components of the cold weather kit.

b. Tire Inner Tube.

(1) Refer to TM 9-2320-230-10 for removal and installation of wheel and tire assemblies.

(2) Refer to TM 9-1870-1 for removal and installation of tires and tubes.

Note. Inflation pressure for tires with tubes is 30 psi.

c. Coolant Heater Control Panel (M656 and XM791) (Fig. 3-15).

(1) *Removal.*

(*a*) Remove nut and two lockwashers securing control panel to top of personnel heater control panel.

(*b*) Remove capscrew, two flat washers, lockwashers, and nut securing control panel bracket to windshield.

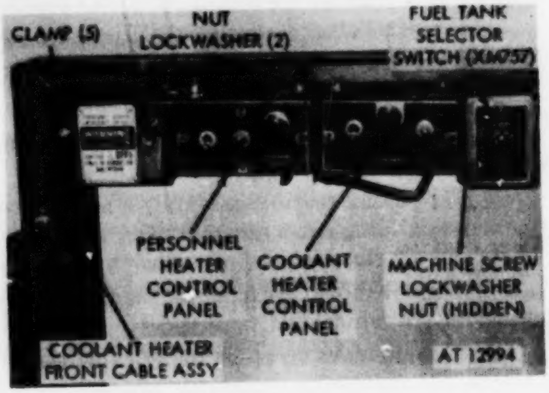


Figure 3-15. Coolant heater control panel.

(*c*) Disconnect two connectors from below and behind control panel.

(*d*) Remove control panel.

(2) *Installation.* Refer to removal instructions and reverse sequence.

d. Coolant Heater Control Panel (*XM757*) (*Fig. 3-15*).

(1) *Removal.*

(*a*) Remove nut and two lockwashers securing control panel top of personnel heater control panel.

(*b*) Remove capscrew, two flat washers, lockwashers, and nut securing control panel bracket to windshield.

(*c*) Disconnect two connectors from behind fuel tank selector switch.

(*d*) Disconnect two connectors from below and behind control panel.

(*e*) Remove cables from control panel by sliding cables and grommet from slot in control panel bracket.

(*f*) Remove control panel and fuel tank selector switch as an assembly.

(*g*) Remove nut and two lockwashers securing fuel tank selector switch to top of control panel.

(*h*) Remove machine screw, lockwasher and nut securing fuel tank selector switch to control panel bracket.

(*i*) Remove control panel.

(2) *Installation.* Refer to removal instructions and reverse sequence.

e. Coolant Heater Front Cable Assembly (*M656 and XM791*) (*Figs. 3-15 and 3-16*).

(1) *Removal.*

(*a*) Disconnect four connectors from below and behind control panels.

(*b*) Remove cable assembly from control panels by sliding cable assembly and two grommets out of slots in control panel brackets.

(*c*) Remove five clamps securing cable assembly to windshield.

(*d*) Remove strap securing cable assembly to air restriction indicator bracket.

(*e*) Disconnect front cable assembly from rear cable assembly.

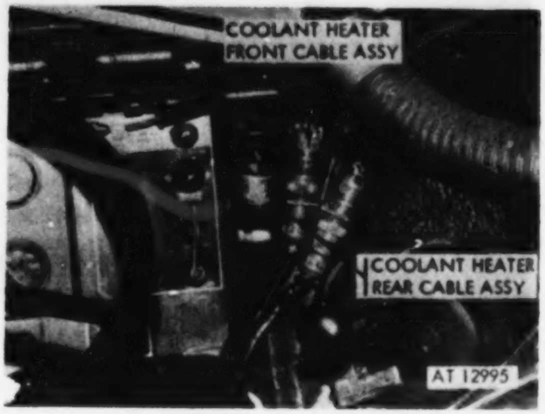

COOLANT HEATER FRONT CABLE ASSY
COOLANT HEATER REAR CABLE ASSY
AT 12995

Figure 3-16. Coolant heater front and rear cable assembly connection.

(*f*) Remove front cable assembly.

(2) Installation. Refer to removal instructions and reverse sequence.

f. Coolant Heater Front Cable Assembly (*XM757*) (*Figs. 3-15 and 3-16.*

(1 *Removal.*

(*a* Disconnect six connectors from below and behind control panels and fuel tank selector switch.

(*b*) Complete removal by following operations (*b*) through (*f*) in *e*(1) above.

(2) *Installation.* Refer to removal instructions and reverse sequence.

g. Coolant Heater Rear Cable Assembly (*Figs. 3-16 and 3-17*).

(1) *Removal.*

(*a*) Disconnect rear cable assembly from coolant heater front cable assembly.

(*b*) Remove 10 straps securing rear cable assembly to personnel heater cable assembly.

(*c*) Disconnect two cable assembly leads to coolant heater pump.

(*d*) Remove two clamps securing cable assembly to coolant heater.

(*e*) Disconnect cable assembly from battery negative cable, vehicle wiring harness, and coolant heater.

(*f*) Remove rear cable assembly.

(2) *Installation.* Refer to removal instructions and reverse sequence. Coat metal parts of coolant heater pump terminals with sealant (MIL-A-46106, RTV 731 or 732).

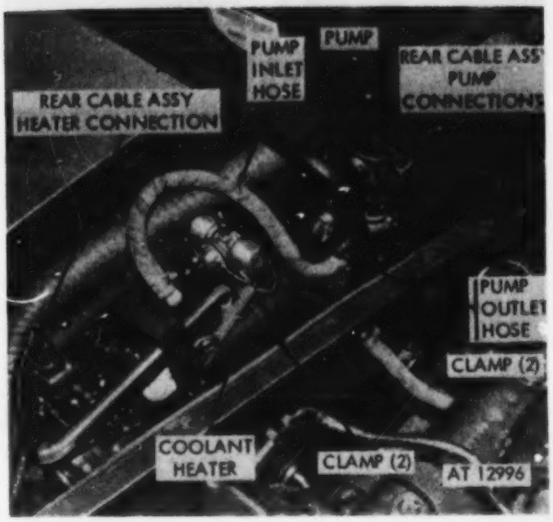

PUMP INLET HOSE
PUMP
REAR CABLE ASS
PUMP
CONNECTIONS
REAR CABLE ASSY
HEATER CONNECTION
PUMP OUTLET HOSE
CLAMP (2)
COOLANT HEATER
CLAMP (2)
AT 12996

Figure 3-17. Coolant heater and pump.

h. Coolant Heater Exhaust Pipes.

(1) *Removal.*

(*a*) Loosen two clamps securing flexible lower exhaust pipe to engine oil pan shroud and upper exhause pipe (fig. 3-18).

(*b*) Remove four capscrews, flat washers, lockwashers, and nuts securing upper exhaust pipe to cab floor (fig. 3-19).

(*c*) Remove upper and lower exhaust pipes and gasket. Discard gasket.

(2) *Installation.* Refer to removal instructions and reverse sequence.

i. Coolant Heater Hoses (Figs. 3-17 and 3-20).

(1) *Removal.*

(*a*) Loosen two clamps securing hose to engine rear stopcock and elbow in engine compartment bulkhead. Remove hose.

(*b*) Remove engine rear stopcock.

(*c*) Loosen two clamps securing hose to engine compartment bulkhead and elbow on underside of coolant heater. Remove hose.

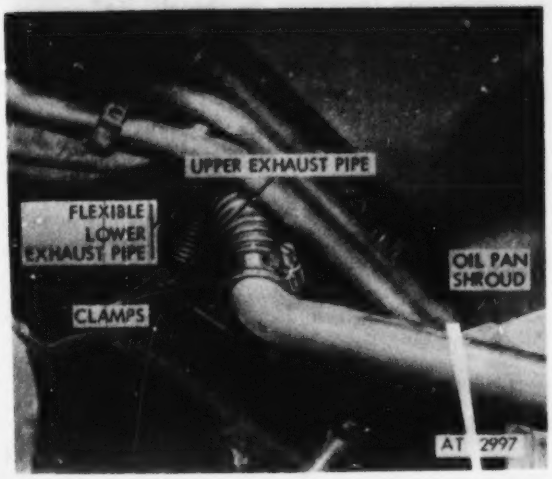

UPPER EXHAUST PIPE
FLEXIBLE LOWER EXHAUST PIPE
OIL PAN SHROUD
CLAMPS
AT 2997

Figure 3-18. Coolant heater exhaust pipes.

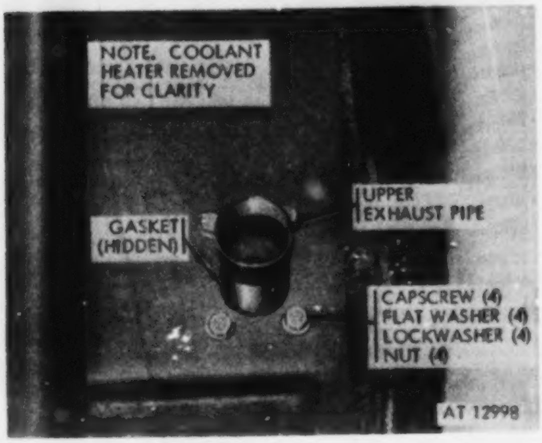

NOTE. COOLANT HEATER REMOVED FOR CLARITY
UPPER EXHAUST PIPE
GASKET (HIDDEN)
CAPSCREW (4)
FLAT WASHER (4)
LOCKWASHER (4)
NUT (4)
AT 12998

Figure 3-19. Coolant heater upper exhaust pipe.

(*d*) Remove nut, elbow, gasket, and washer from engine compartment bulkhead. Discard gasket.

(*e*) Remove elbow from underside of heater.

(*k*) Loosen two clamps securing hose to front stopcock and engine compartment bulkhead. Remove hose.

(*g*) Remove stopcock, reducer, and nipple from front of engine.

(*h*) Loosen two clamps securing hose to engine compartment bulkhead and battery tray. Remove hose.

(*i*) Remove nut, gasket, washer, and elbow from engine compartment bulkhead. Discard gasket.

(*j*) Loosen two clamps securing hose to pump outlet and battery tray. Remove hose.

(*k*) Loosen two clamps securing hose to pump inlet and top of coolant heater. Remove hose.

(2) *Installation.* Refer to removal instructions and reverse sequence.

j. Coolant Heater Pump (*Fig. 3-21*).

(1) *Removal.*

(*a*) Disconnect two electrical leads from pump.

(*b*) Loosen two clamps and disconnect hoses from pump inlet and outlet.

(*c*) Remove clamp securing pump bracket to seat support.

(*d*) Remove two capscrews, lockwashers, and nuts securing pump bracket to seat support bracket.

(*e*) Remove pump and pump bracket.

(*f*) Remove elbow from pump inlet.

(*g*) Remove four capscrews and lockwashers securing pump to bracket.

(2) *Installation.* Refer to removal instructions and reverse sequence. Coat metal parts of pump terminals with sealant (MIL-A-46106, RTV 731 or 732).

k. Coolant Heater (*Fig. 3-17*).

(1) *Removal.*

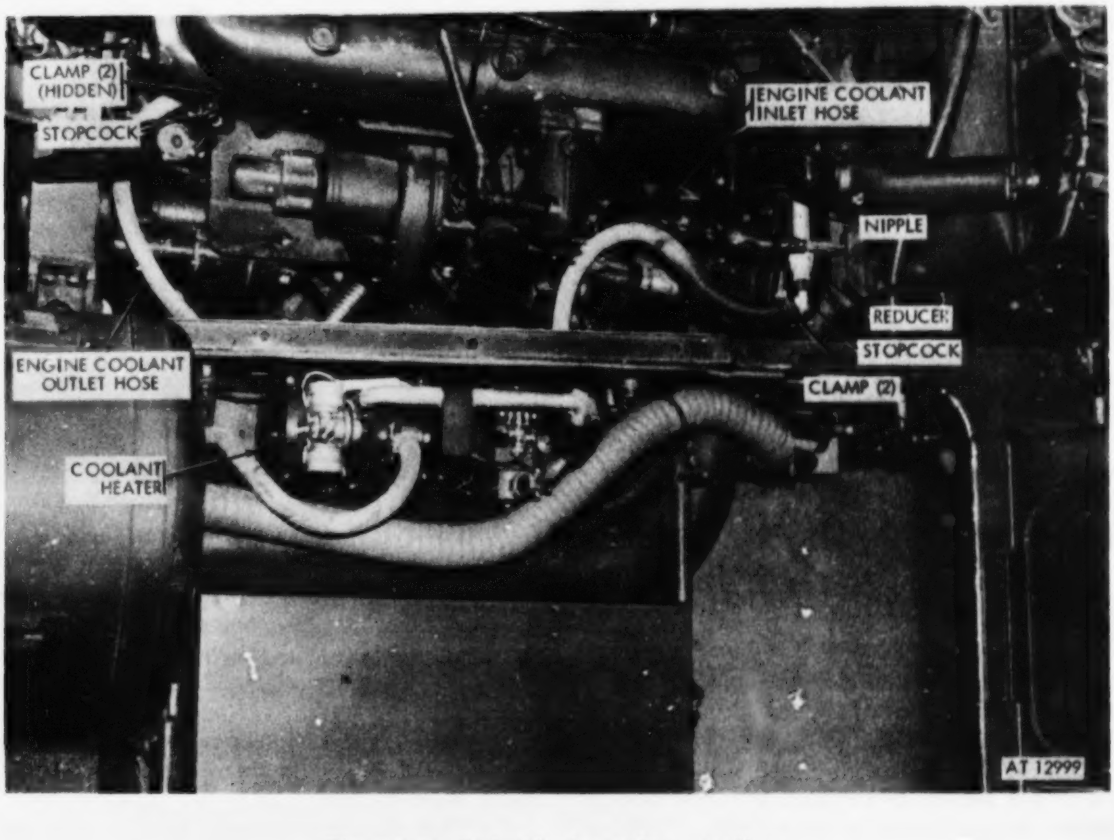

CLAMP (2) (HIDDEN)
STOPCOCK
ENGINE COOLANT INLET HOSE
NIPPLE
REDUCER
STOPCOCK
CLAMP (2)
ENGINE COOLANT OUTLET HOSE
COOLANT HEATER
AT 12999

Figure 3-20. Coolant heater engine connections.

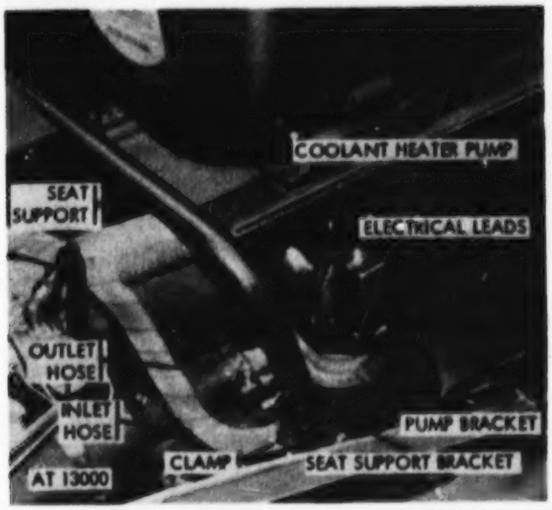

COOLANT HEATER PUMP
SEAT SUPPORT
ELECTRICAL LEADS
OUTLET HOSE
INLET HOSE
PUMP BRACKET
CLAMP
SEAT SUPPORT BRACKET
AT 13000

Figure 3-21. Coolant heater pump.

(*a*) Disconnect electrical connector.

(*b*) Remove four capscrews, flat washers, lockwashers, and nuts securing heater brackets to cab floor. Remove heater and brackets.

(*c*) Loosen two clamps and disconnect hoses from heater inlet and outlet.

Note. Heater exhaust outlet is a friction fit to upper exhaust pipe.

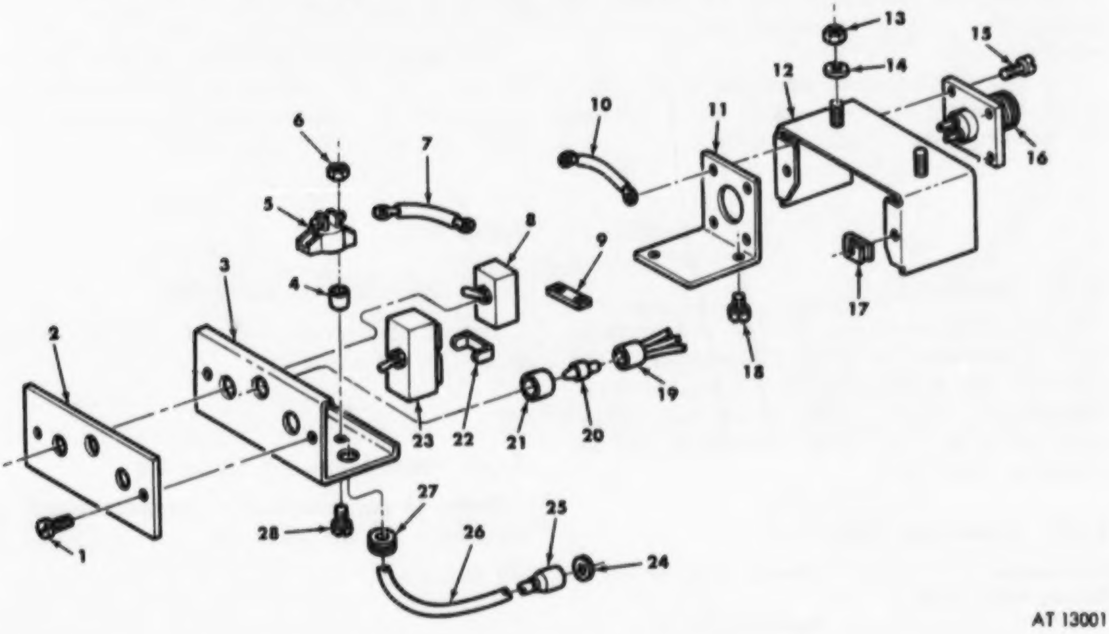
(*d*) Remove two clamps securing heater to brackets. Remove brackets from heater.

(2) *Installation.* Refer to removal instructions and reverse sequence.

l. Coolant Heater RUN-OFF-START Switch (Fig. 3-22).

(1) *Removal.*

(*a*) Disconnect two electrical connectors


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
AT 13001

1—Machine screw (2)
2—Panel
3—Panel
4—Spacer (2)
5—Circuit breaker
6—Nut (2)
7—Cable assembly
8—HI-LO switch
9—Connector
10—Cable assembly
11—Bracket
12—Control box
13—Nut (2)
14—Washer (2)
15—Machine screw (4)
16—Cable assembly
17—Nut (2)
18—Machine screw (2)
19—Cable assembly
20—Lamp
21—Pushbutton and jewel
22—Jumper
23—RUN-OFF-START switch
24—Washer
25—Shell
26—Cable assembly
27—Grommet
28—Machine screw (2)

Figure 3-22. Coolant heater control box, exploded view.

from behind and below coolant heater control panel.

(*b*) Remove two machine screws (1) securing bottom and front panel (3) to control box (12). Remove front and bottom panel.

(*c*) Disconnect five electrical leads from switch (23).

Note. Wire number 14 is connected to switch upper terminal. Wire number 19 is connected to switch lower terminal. Wire number 15 is connected to switch right center terminal (facing rear of switch). Wire number 20 is connected to switch left center terminal.

(*d*) Remove mounting nut. Remove switch.

(2) *Installation.* Refer to removal instructions and reverse sequence.

m. Coolant Heater HI-LO Switch (Fig. 3-22).

(1) *Removal.*

(*a*) Disconnect two electrical connectors from behind and below coolant heater control panel.

(*b*) Remove two machine screws (1) securing bottom and front panel (3) to control box (12). Remove bottom and front panel.

(*c*) Disconnect two electrical leads from switch (8).

Note. Wire number 13 is connected to switch upper terminal. Wire number 12 is connected to switch lower terminal.

(*d*) Remove mounting nut. Remove switch.

(2) *Installation.* Refer to removal instructions and reverse sequence.

n. Coolant Heater Indicator Lamp (Fig. 3-22).

(1) *Removal.* Remove press-to-test pushbutton and jewel (21) from coolant heater control panel. Remove lamp (20).

(2) *Installation.* Install lamp (20). Install press-to-test pushbutton and jewel (21).

3-17. Parts List

The spare parts and components of the arctic kit (−65° F.), allocated for replacement by organizational maintenance personnel, are listed in TM 9-2320-230-20P.

Section IV. SLAVE KIT

3-18. General

This section contains service and maintenance procedures for those components of the slave kit (fig. 3-23) which are allocated to organizational maintenance personnel. These components are: the cable assemblies, and the attaching hardware.

3-19. Tabulated Data

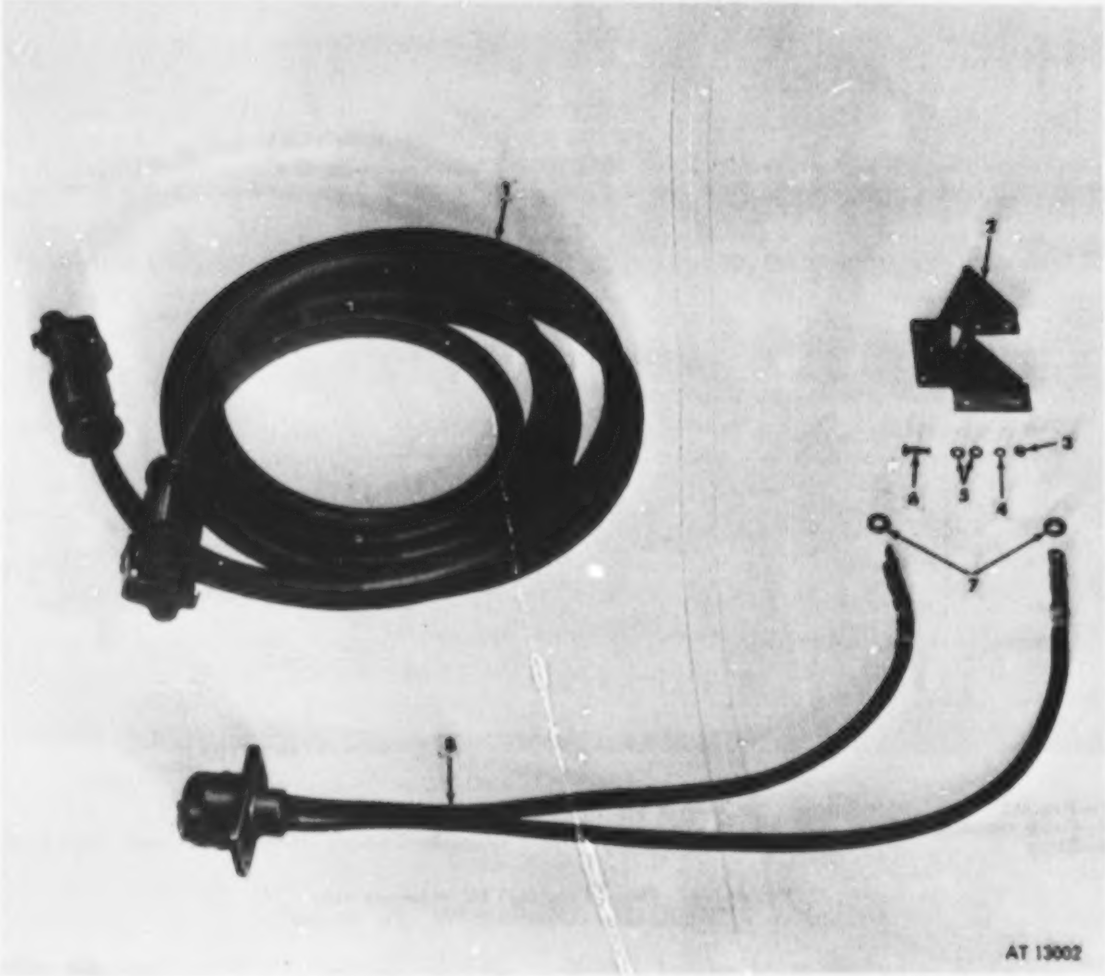
Part number	11600511
Battery cable circuit number	Negative (No. 50) Positive (No. 49)
Slave receptacle	7321299

3-20. Removal of Slave Kit

Refer to paragraph 3-9*l* for removal instructions for the slave kit.

3-21. Installation of Slave Kit

Refer to paragraph 3-9*l* for installation instructions for the slave kit.



1—Extension cable
2—Bracket
3—Nut (10)
4—Lockwasher (10)
5—Flat washer (16)
6—Capscrew (10)
7—Grommets
8—Cable assembly

Figure 3-23. Slate kit, reference view.

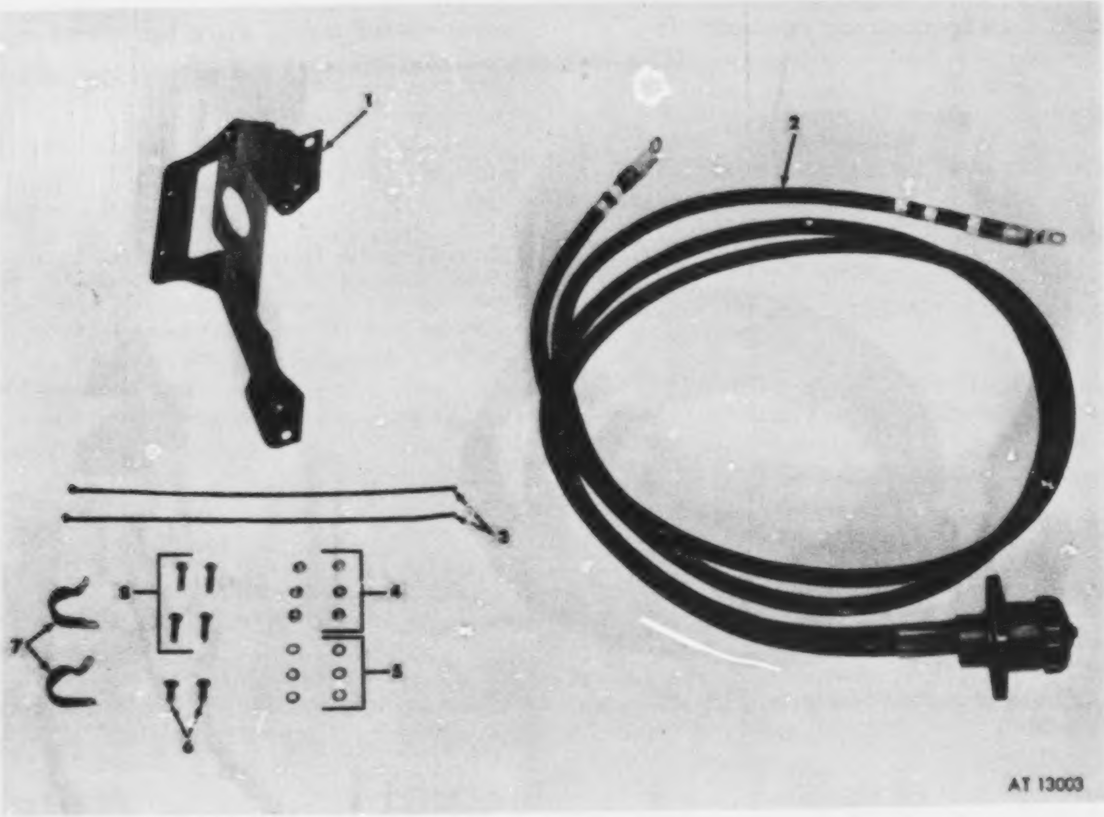
Section V. SLAVE (PERSHING) KIT

3-22. General (Fig. 3-24)

This section contains service and replacement procedures for those components of the slave (Pershing) kit which are allocated to organizational maintenance personnel. These components are: the cable assembly and attaching hardware.

3-23. Tabulated Data

Part number 11614248



1—Bracket
2—Cable assembly
3—Strap
4—Nut (6)
5—Lockwasher (6)
6—Capscrew
7—Clip
8—Capscrew (4)

Figure 3-24. Slave (Pershing) kit, reference view.

3-24. Removal of Slave (Pershing) Kit (Figs. 3-25 and 3-26)

a. Remove lead No. 50 (negative) from negative terminal of starter.

b. Remove lead No. 49 (positive) from positive terminal of starter solenoid.

c. Remove two straps holding cable to air lines.

d. Release cable receptacle from bracket by removing four nuts, screws and lockwashers.

e. Remove nuts, lockwashers, capscrews, and clips securing cables to bracket.

f. Pull cables through bracket assembly and remove.

3-25. Repair of Slave (Pershing) Kit

The repair of the slave (Pershing) kit is limited to replacement of cables.

3-26. Installation of Slave (Pershing) Kit

a. Refer to removal procedure (para 3-24) and reverse sequence.

b. Coat all metal parts of terminals with sealant (MIL-A-46106, RTV 731 or 732).

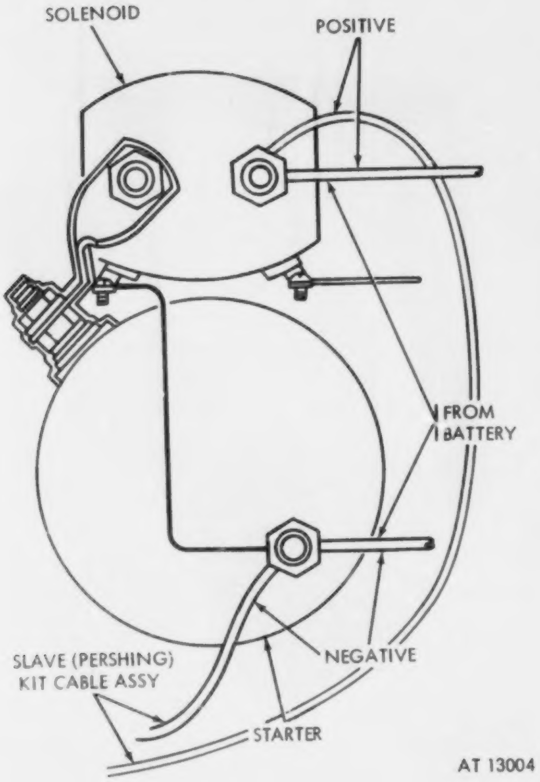

SOLENOID
POSITIVE
FROM BATTERY
SLAVE (PERSHING) KIT CABLE ASSY
NEGATIVE
STARTER
AT 13004

Figure 3-25. Slave (Pershing) kit starter connections.

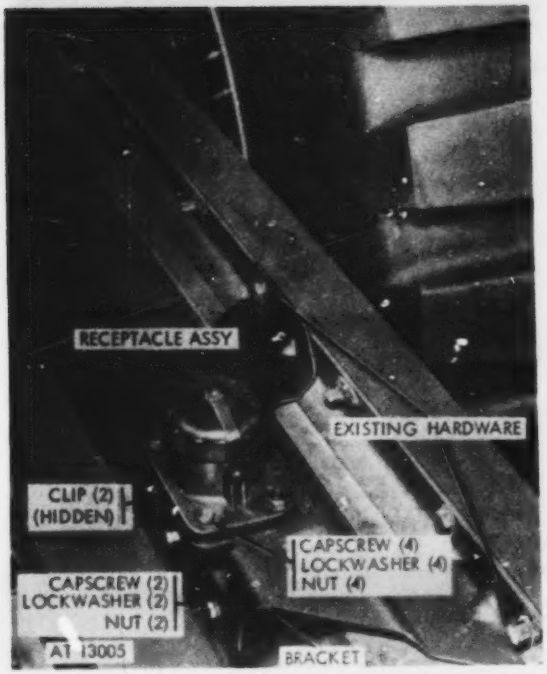

RECEPTACLE ASSY
EXISTING HARDWARE
CLIP (2) (HIDDEN)
CAPSCREW (4)
LOCKWASHER (4)
NUT (4)
CAPSCREW (2)
LOCKWASHER (2)
NUT (2)
AT 13005
BRACKET

Figure 3-26. Slave (Pershing) kit cable assembly and bracket.

Section VI. WINDSHIELD DEFOGGING KIT

3-27. General

This section contains instructions for service and replacement of those components of the windshield defogging kit (fig. 3-27) which are allocated to organizational maintenance personnel. These components are: the blower assembly, the hoses, the wiring harness, and attaching hardware.

3-28. Tabulated Data

Kit part number	11600507
Blower assembly part number	11313697
Motor part number	8720660-1
Switch part number	11613698

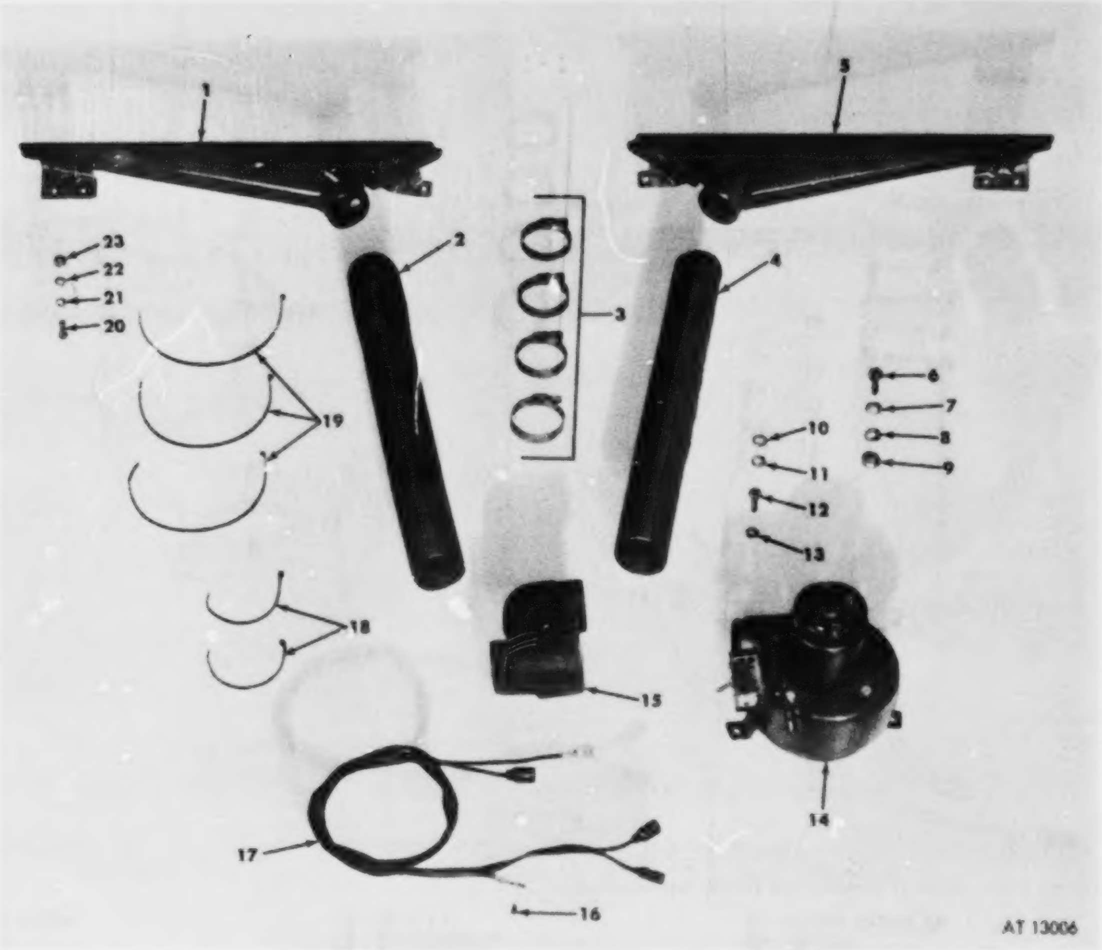
3-29. Service Upon Receipt of Materiel

Material received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-20.

3-30. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed to detect any defects which might result in damage or failure. Any defects beyond the scope of the operator or organizational maintenance personnel must be reported to direct support maintenance.

b. Table 3-5 lists preventive-maintenance services to be performed before, during, and after operation of the windshield defogging kit.



1—Left nozzle
2—Hose
3—Clamp (4)
4—Hose
5—Right nozzle
6—Capscrew (3)
7—Flat washer (5)
8—Lockwasher (3)
9—Nut (3)
10—Lockwasher
11—Lockwasher
12—Screw (3)
13—Lockwasher (3)
14—Blower assembly
15—Diverter
16—Screw
17—Cable assembly
18—Strap
19—Strap
20—Capscrew (6)
21—Flat washer (6)
22—Lockwasher (6)
23—Nut (6)

Figure 3-27. Defogging kit, reference view.

Table 3-5. Preventive-Maintenance Checks and Services for Windshield Defogging Kit

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
1	Attaching Hardware	Check all screws, nuts, and attaching clamps for tightness.	Para 3-32
2	Hoses	Check hoses for restrictions, cracks and improper connection.	Para 3-32*b*

Table 3-5. Preventive-Maintenance Checks and Services for Windshield Defogging Kit—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
3	All Components	Check for overall dirt, rust, and grease.	Para 3–32
4	Switch	Check for positive operation of switch.	Para 3–32*e*
5	Blower	Check air intake of blower to make sure it is free of obstructions. Listen for unusual noises when blower is in operation.	Para 3–32*c*
6	Nozzles	Check windshield nozzles for free and even flow of air.	Fig 3–28

3–31. Troubleshooting

Table 3–6 is a troubleshooting chart listing malfunctions, probable causes and corrective actions to be taken. The sequence of probable causes listed is given in order of probability.

Table 3–6. Troubleshooting Windshield Defogging Kit

Malfunction	Probable causes	Corrective action
1. Blower fails to start.	*a.* Low battery voltage.	*a.* Observe battery-generator indicator. If indication is low, check electrical system and correct low voltage condition.
	b. Defective switch or electrical cable.	*b.* Check electrical connections, switch, circuit breakers. Replace defective parts.
	c. Defective blower assembly.	*c.* Check blower for obstruction in housing or impeller. Replace blower assembly.
2. Insufficient or no air delivery at windshield nozzles.	*a.* Hoses loose, cracked, or broken.	*a.* Check hoses, connections, and clamps. Tighten or replace as required.
	b. Restrictions in blower or hoses.	*b.* Clean windshield nozzles, hoses, and blower housing.

3–32. Replacement of Windshield Defogging Kit Components

a. Electrical Cable.

(1) *Removal.*

(*a*) Remove cable (female) connector (No. 25) from circuit breaker.

(*b*) Remove horn connector (No. 25) from defogging cable (male) connector.

(*c*) Remove two straps and disengage cable from air line.

(*d*) Remove screws, lockwasher and flat washer and disconnect ground lead of cable assembly from low air warning horn.

(*e*) Remove three straps and remove cable from left defogging hose.

(*f*) Disconnect cable assembly from blower lead.

(*g*) Remove screw, lockwasher, flat washer and nut on blower left bracket leg and remove ground.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Hoses (Fig. 3–28).

(1) *Removal.*

(*a*) Loosen two clamps and remove right and left hoses from defogging nozzles.

(*b*) Loosen two clamps on hoses at blower diverter and remove hoses.

(2) *Installation.* Refer to removal procedure and reverse sequence.

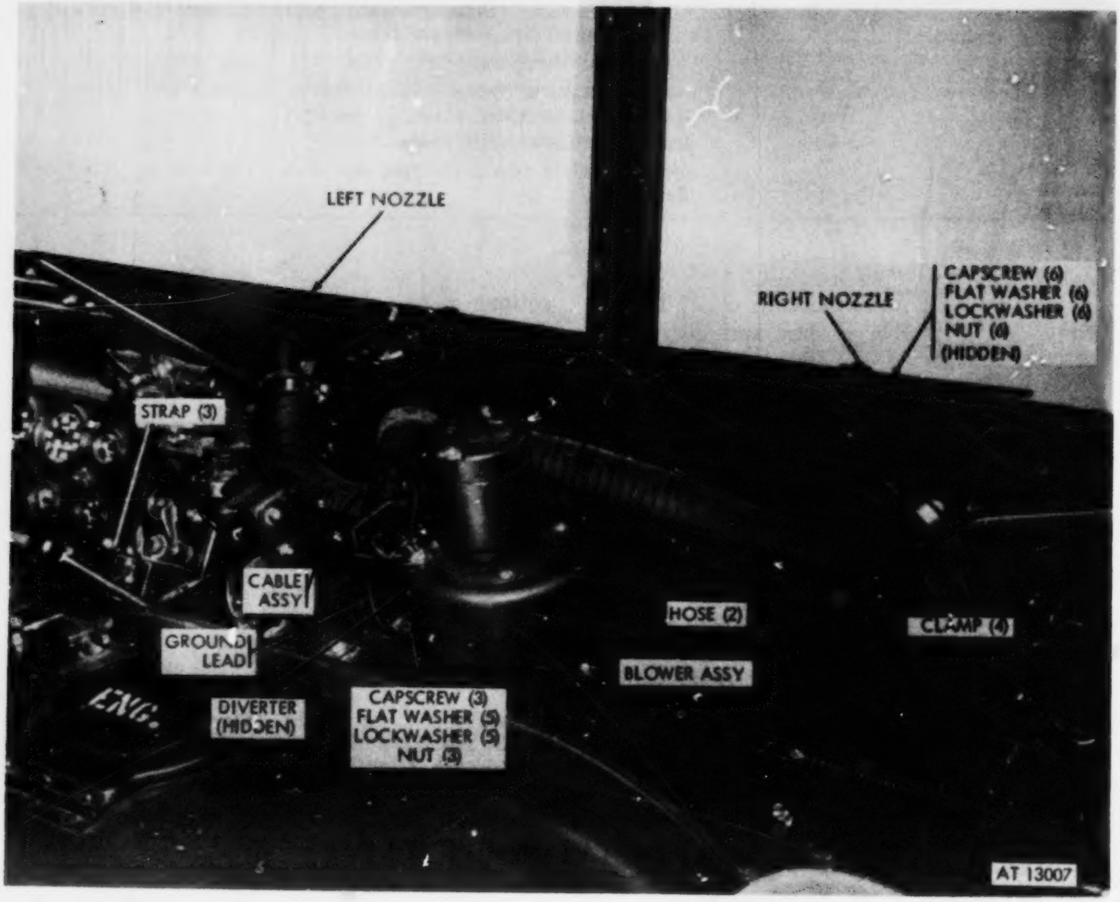

LEFT NOZZLE
RIGHT NOZZLE
CAPSCREW (6)
FLAT WASHER (6)
LOCKWASHER (6)
NUT (6)
(HIDDEN)
STRAP (3)
CABLE ASSY
GROUND LEAD
DIVERTER (HIDDEN)
CAPSCREW (3)
FLAT WASHER (5)
LOCKWASHER (5)
NUT (3)
HOSE (2)
BLOWER ASSY
CLAMP (4)
ENG.
AT 13007

Figure 3-28. Defogging kit, installed view.

c. Blower and Diverter.

(1) *Removal (fig. 3-28).*

(*a*) Loosen two clamps and disconnect defogging hoses from diverter.

(*b*) Disconnect cable from blower lead. Remove screw, lockwasher, flat washer and nut retaining ground lead to blower bracket leg.

(*c*) Remove screws, lockwashers, flat washers, and nuts retaining blower bracket right and front legs. Left out blower and diverter.

(*d*) Remove three screws and lockwashers. Separate diverter from blower.

(2) *Installation.* Refer to removal procedure and reverse sequence.

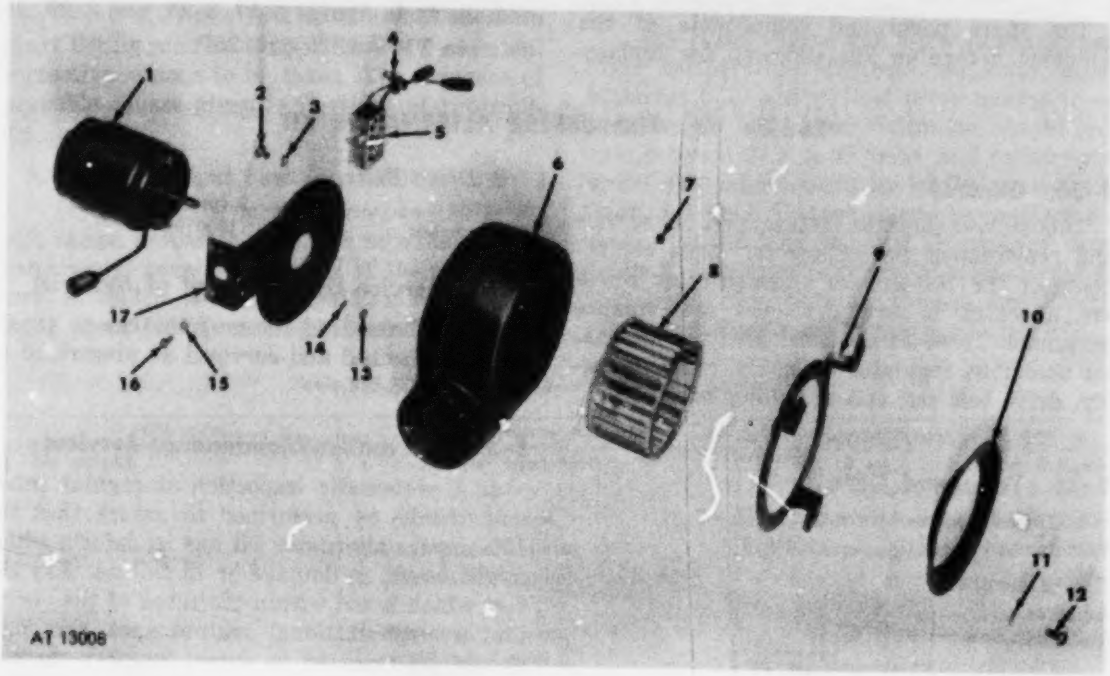
d. Blower Motor Assembly.

Note. Key numbers in parentheses are in figure 3-29.

(1) *Removal.*

(*a*) Remove blower as directed in paragrapn *c* above.

(*b*) Disconnect motor electrical lead from switch assembly.



1—Motor assembly
2—Machine screw (4)
3—Lockwasher (4)
4—Clamp
5—Switch assembly
6—Housing
7—Setscrew
8—Impeller
9—Bracket
10—Lower flange
11—Lockwasher (4)
12—Machine screw (4)
13—Nut (2)
14—Lockwasher (2)
15—Lockwasher (2)
16—Machine screw (2)
17—Upper flange

Figure 3-29. Defogging kit blower assembly, exploded view.

(*c*) Remove four screws (12) and lockwashers (11) securing flange (10) and bracket (9) to housing (6).

(*d*) Loosen setscrew (7) and remove impeller (8).

(*e*) Remove machine screws (2) and lockwashers (3) securing upper flange (17) to housing (6).

(*f*) Remove upper flange (17), with motor (1) and switch assembly (5) attached, from housing (6).

(*g*) Remove two nuts (13) and lockwashers (14) securing motor (1) to upper flange (17). Remove motor.

(2) *Installation.* Refer to removal instructions and reverse sequence.

e. Blower Switch Assembly.

Note. Key numbers in parentheses are in figure 3-29.

(1) *Removal.*

(*a*) Disconnect switch assembly (5) from motor (1).

(*b*) Remove machine screw (2) and lockwasher (3) securing cable clamp (4) to upper flange (17). Remove clamp.

(*c*) Remove two machine screws (16), and lockwashers (15) securing switch assembly (5) to upper flange (17). Remove switch assembly.

(2) *Installation.* Refer to removal instructions and reverse sequence.

3-33. Parts List

The spare parts and components of the windshid defogging kit, allocated for replacement by organizational maintenance personnel and shown in figures 3-27, 3-28, and 3-29, are listed in TM 9-2320-230-20P.

Section VII. 100-AMPERE ALTERNATOR KIT

3-34. General

This section contains instructions for service and replacement procedures for those components of the 100-ampere alternator kit which are allocated to organizational maintenance personnel. These components are: the alternator assembly, regulator assembly, cable assembly, drive belt set, and attaching hardware.

a. 100-Ampere Alternator Kit.

3-35. Tabulated Data

a. 100-Ampere Alternator Kit.

Part number	11600613

b. Alternator.

Amperes	100
Volts DC	28
Part number	10947517

c. Regulator.

Amperes	100
Volts DC	Adjustable 24-27
Part number	11639436

d. Drive Belts.

Quantity	3 (matched set)
Part number	11600791-2

3-36. Service Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-37.

3-37. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed to assure that the 100-ampere alternator kit has no defects which might result in damage or in failure. Any defect which is not within the scope of the operator or organizational maintenance personnel should be reported to direct support maintenance.

b. Table 3-7 lists preventive-maintenance services to be performed.

Table 3-7. Preventive-Maintenance Checks and Services for 100-Ampere Alternator Kit

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
1	Belt	Check for fan and alternator belt tension. All belts should have approximately 1/2-inch deflection.	Para 3-39c
2	Mountings and Attaching Hardware	Check alternator and regulator mounting screws, bolts, and nuts for tightness.	Para 3-39c
3	Electrical System	Determine that all cable connectors are tight. Check for breaks in conduits and harnesses. Check battery cables for tightness and condition. Tighten, clean, or replace, as required.	Para 3-39a
4	Battery-Generator Indicator	Turn ignition on; battery-generator indicator should move to yellow band. Start engine. Allow engine to reach operating temperature and observe battery-generator indicator. At approximately 1,500 rpm, indicator should stay in green band. Turn ignition off. If indicator is not in yellow band, troubleshoot the alternator system (table 3-8).	Para 3-39

3-38. Troubleshooting

a. General. Table 3-8 is a troubleshooting chart listing malfunctions, probable causes and corrective actions to be taken. The sequence of probable causes given is in order of probability.

b. Voltage Output Test.

(1) Connect a dc voltmeter, having a 50-volt range, across the positive terminal of one battery and negative terminal of the other battery. If vehicle is equipped with a slave receptacle, check voltage at the receptacle. Observe voltmeter. If voltmeter indicates less than 18 volts, replace both batteries.

(2) Start engine and allow to reach operating temperature. Connect voltmeter across batteries ((1) above) and bring engine to approximately 1,500 rpm. Voltmeter should indicate between 27.5 to 28 volts, and battery-generator indicator should be in the green band. Turn on lights. Voltage should be constant and remain at 27.5 to 28 volts. If voltage drops below 27.5 volts, or exceeds 28 volts during the test, adjust the regulator voltage. See Electrical Troubleshooting, Chapter 2, Section VII.

Table 3-8. Troubleshooting—100-Ampere Alternator Kit

Malfunction	Probable causes	Corrective action
1. No output.	*a.* Broken or loose belts.	*a.* Adjust belts to 1/2 inch deflection or replace belts (para 3-39*c*).
	b. Alternator seized.	*b.* Replace alternator (para 3-39*c*).
	c. Defective alternator.	*c.* Replace alternator (para 3-39*c*).
	d. Broken wire in cable assembly.	*d.* Replace or repair as required (para 3-39*a*).
	e. Disconnected wire.	*e.* Tighten all wires and connections.
	f. Defective regulator.	*f.* Replace regulator (para 3-39*b*).
	g. One or both batteries defective.	*g.* Replace batteries.
2. Low output; less than 27 volts.	*a.* Loose belts.	*a.* Adjust belts (para 3-39*c*).
	b. Loose connection.	*b.* Tighten connectors.
	c. Regulator out of adjustment.	*c.* Adjust voltage regulator rheostat (para 2-20) or replace (para 3-39*b*).
	d. One or both batteries defective.	*d.* Replace batteries.
	e. Defective alternator.	*e.* Replace alternator (para 3-39*c*). ***Caution:* Reversing polarity of battery will damage alternator.**
3. High output; more than 28.5 volts.	*a.* One or both batteries low.	*a.* Replace batteries.
	b. Regulator out of adjustment.	*b.* Adjust or replace regulator (para 3-39*b*).
	c. Wire shorted.	*c.* Check wiring.
4. Battery-generator indicator	*a.* Faulty indicator.	*a.* Connect voltmeter with 50-volt dc scale across vehicle battery. Check voltage; if between 27.5 and 28, replace indicator.
	b. Broken connection.	*b.* Check wiring.
	c. No output of alternator system.	*c.* See items 1 and 2 above.
	d. One or both batteries defective.	*d.* Replace batteries.
	e. Low voltage setting.	*e.* Adjust voltage regulator (para 2-20).
5. Belt squeal.	*a.* Burnished belts.	*a.* Install new belt set (para 3-39*c*).
	b. One or more worn or broken belts.	*b.* Install new belt set (para 3-39*c*).
	c. Alternator seized.	*c.* Replace alternator (para 3-39*c*).
	d. Loose belts.	*d.* Adjust belt tension (para 3-39*c*).
	e. Seized water pump.	*e.* Replace pump (para 2-82).

Malfunction	Probable causes	Corrective action
6. Battery uses too much water.	*a.* High voltage setting.	*a.* Adjust voltage regulator (para 2-20).
	b. Cracked battery case.	*b.* Replace battery.
7. Battery does not hold charge.	*a.* Voltage regulator incorrectly adjusted.	*a.* Adjust voltage regulator (para 2-20) or replace regulator (para 3-39b).
	b. One or both batteries defective.	*b.* Replace batteries.
	c. Slipping belts.	*c.* Refer to item 5 above.

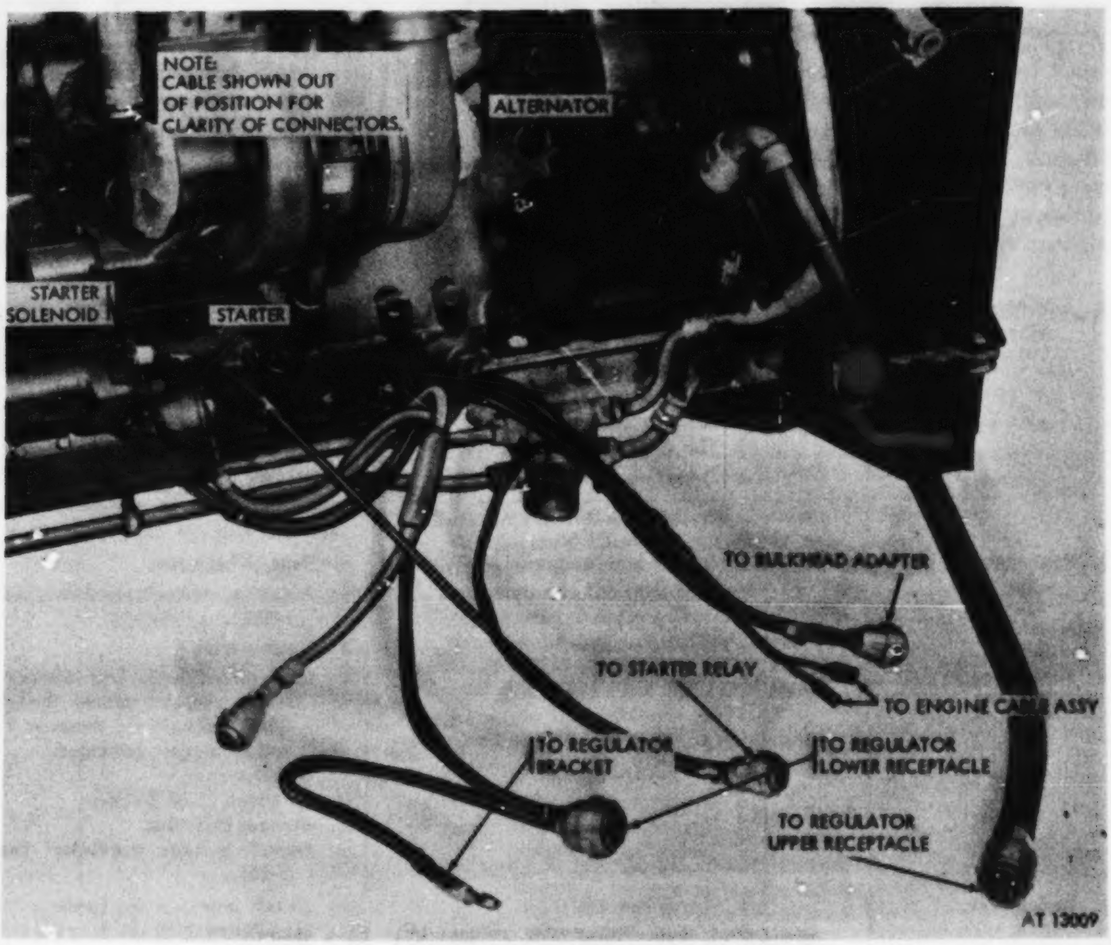

NOTE:
CABLE SHOWN OUT OF POSITION FOR CLARITY OF CONNECTORS.
ALTERNATOR
STARTER SOLENOID
STARTER
TO BULKHEAD ADAPTER
TO STARTER RELAY
TO ENGINE CABLE ASSY
TO REGULATOR BRACKET
TO REGULATOR LOWER RECEPTACLE
TO REGULATOR UPPER RECEPTACLE
AT 13009

Figure 3-30. 100-ampere alternator cable connections.

3-39. Maintenance Instructions for Replacement of 100-Ampere Alternator Kit

a. Cable Assembly (Fig. 3-30).

(1) *Removal.*

(*a*) Disconnect and remove cable assembly from regulator to alternator.

(*b*) Remove screw, flat washer, lockwasher, and nut and disconnect ground connection from regulator bracket.

(*c*) Disconnect lead at regulator lower receptacle.

(*d*) Remove strap holding cable to transmission air pressurization lines.

(*e*) Disconnect leads Nos. 6 and 14 at starter.

(*f*) Disconnect lead from starter relay.

(*g*) Disconnect leads Nos. 568 and 14A from engine cable assembly.

(*h*) Disconnect connector (positive No. 6) from engine compartment bulkhead.

(*i*) Remove cable assembly.

(2) *Installation.*

(*a*) Refer to removal procedure and reverse sequence.

(*b*) Use sealant (MIL-A-46106) over all metal parts of terminals.

b. Regulator (Fig. 3-31).

(1) *Removal.*

(*a*) Disconnect cable assembly from regulator upper receptacle.

(*b*) Remove screw, two lockwashers, flat washer and nut at upper hole of regulator bracket and remove ground.

(*c*) Disconnect lead from lower receptacle of regulator.

(*d*) Remove regulator and brackets by removing remaining three screws, flat washers, lockwashers, and nuts.

(*e*) Remove four screws and lockwashers securing regulator to brackets; remove regulator.

(2) *Installation.* Refer to removal procedure and reverse sequence.

c. Alternator, Pulley and Belts (Fig. 3-32).

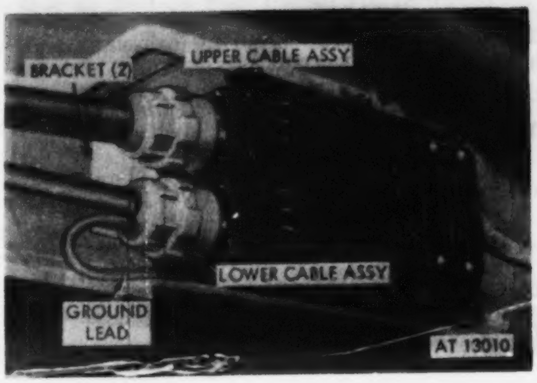


Figure 3-31. 100-ampere alternator regulator.

(1) *Removal.*

(*a*) Disconnect electrical cable from alternator.

(*b*) Remove adjusting strap from alternator.

(*c*) Remove three drive belts.

(*d*) Attach lifting sling to alternator and remove three screws and lockwashers retaining alternator and bracket to engine. Remove alternator and bracket from vehicle.

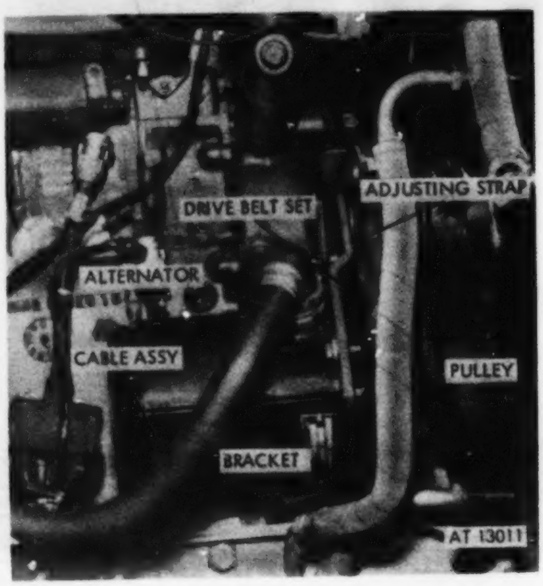


Figure 3-32. 100-ampere alternator assembly.

(*e*) Remove two screws, four lockwashers, and two nuts securing alternator to bracket. Remove bracket.

(*f*) Remove nut and flat washer securing pulley to alternator.

(*g*) Using a suitable puller, remove pulley from alternator.

(*h*) Remove key from alternator shaft.

(2) *Installation.*

(*a*) Refer to removal procedure and reverse sequence.

(*b*) Adjust tension on drive belts to 1/2 inch deflection.

3-40. Parts List

The spare parts and components of the 100-ampere alternator kit allocated for replacement by organizational maintenance personnel are listed in TM 9-2320-230-20P.

Section VIII. AIRBRAKE HAND CONTROL KIT (M656 AND M791)

3-41. General

This section contains instructions for service and replacement procedures for those components of the airbrake hand control kit (fig. 3-33) which are allocated to organizational maintenance personnel. These components are: the brake valve, coupling assembly, switch assembly and hose assembly.

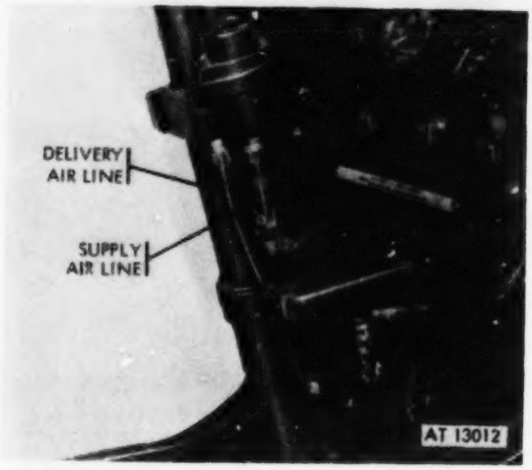


Figure 3-33. Airbrake hand control, installed view.

3-42. Tabulated Data

Hand control valve:

Part number	11602159
Operation	Manual
Control	Variable

3-43. Service Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-44.

3-44. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed by organizational maintenance personnel in order that defects may be detected and corrected before damage or failure results, and to determine that operator and crew maintenance is being performed. Any defects or improper operation beyond the scope of organizational maintenance personnel must be reported to direct support maintenance.

b. Table 3-9 lists preventive-maintenance services to be performed or supervised by organizational maintenance personnel.

Table 3-9. Preventive-Maintenance Checks and Services for Airbrake Hand Control Kit

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
1	Air Line Connections	Using a soap solution, check all connections for leaks. Tighten leaking connection.	Para 3-46
2	Mounting Hardware	Check hand control valve and floor coupling hardware for tightness.	Paras 3-46*a* and 3-46*b*

Table 3–9. Preventive-Maintenance Checks and Services for Airbrake Hand Control Kit—Continued

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
3	Stoplight Switch Operation	Disconnect electrical leads from stoplight switch. Operate hand control valve. Check electrical continuity between terminals on stoplight switch.	Para 3–46c
4	Hand Control Valve Operation	Operate hand control valve.	TM 9–2320–230–10

3–45. Troubleshooting the Airbrake Hand Control Kit

Table 3–10 is a troubleshooting chart listing malfunctions, probable causes, and corrective action to be taken. The sequence of probable causes is given in order of probability.

Table 3–10. Troubleshooting—Airbrake Hand Control Kit

Malfunction	Probable causes	Corrective action
Trailer brakes do not actuate operated.	*a.* Trailer airhose not connected.	*a.* Connect trailer airhose.
	b. Service-air shutoff valve closed.	*b.* Open service valve.
	c. Truck tractor protection valve in "emergency" position.	*c.* Reposition control valve to normal position.
	d. Defective double check valve.	*d.* Replace check valve (para 2–170*f*).
	e. Defective hand control valve.	*e.* Replace hand control valve (para 3–46*a*)...
	f. Defective truck tractor protection valve.	*f.* Replace truck tractor protection valve (para 2–174).

3–46. Removal and Replacement of Components of the Airbrake Hand Control Kit

Note. Before removing any component of the airbrake hand control kit, bleed all air from system by alternately opening drain cocks on three air reservoirs.

Note. During installation apply sealing compound (MIL–S–45180, type II) to all pipe threads prior to assembly.

a. Brake Valve.

(1) *Removal (figs. 3–33 and 3–34).*

(*a*) Disconnect delivery and supply air lines from hand control valve.

(*b*) Remove two screws and washers securing hand control valve clamp to valve body. Remove clamp and hand control valve.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Floor Coupling.

(1) *Removal.*

(*a*) Disconnect stoplight switch air line at coupling adapter under cab floor.

(*b*) Remove adapter from coupling.

(*c*) Disconnect hand control valve dilivery air line at coupling elbow on cab floor (fig. 3–35).

(*d*) Remove elbow from coupling.

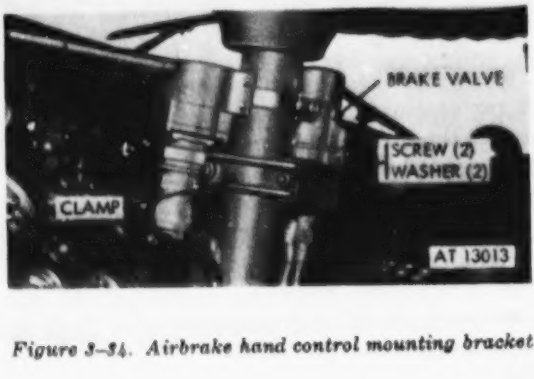


Figure 3–34. Airbrake hand control mounting bracket.

(*e*) Remove coupling nut, lockwasher, and flat washer from under cab floor.

(*f*) Remove coupling bolt, flat washer, and gasket from cab floor.

(2) *Installation.* Refer to removal procedure and reverse sequence.

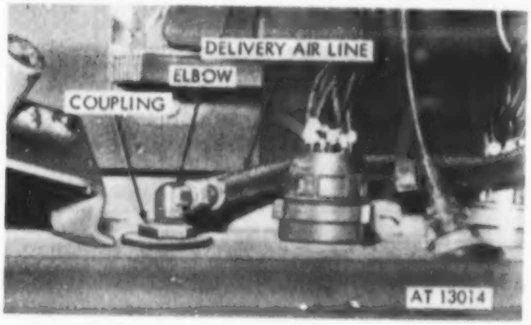


Figure 3-35. Airbrake hand control floor coupling.

c. Stoplight Switch.

(1) *Removal (fig. 3-36).*

(*a*) Disconnect two electrical connectors from stoplight switch.

(*b*) Disconnect cab floor coupling air line from stoplight switch.

(*c*) Disconnect truck tractor protection air line from stoplight switch.

(*d*) Remove stoplight switch from brake treadle valve elbow.

(2) *Installation.* Refer to removal procedure and reverse sequence.

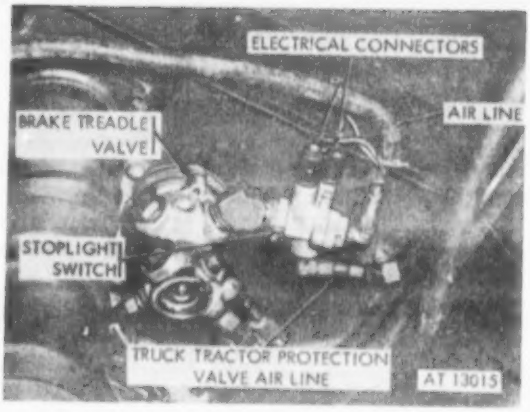


Figure 3-36. Airbrake hand control stoplight switch.

d. Hose Assembly.

(1) *Removal.* Disconnect hose assembly at manifold located at cab rear crossmember and at single connection manifold located to rear of front left bogie support. Remove hose assembly.

Note. Hose assembly and cab rear manifold connection are labeled "17".

(2) *Installation.* Refer to removal procedure and reverse sequence.

3-47. Parts List

The repair parts allocated for replacement at organizational maintenance are listed in TM 9-2320-230-20P.

Section IX. MACHINEGUN MOUNT KIT (M656 AND M757)

3-48. General

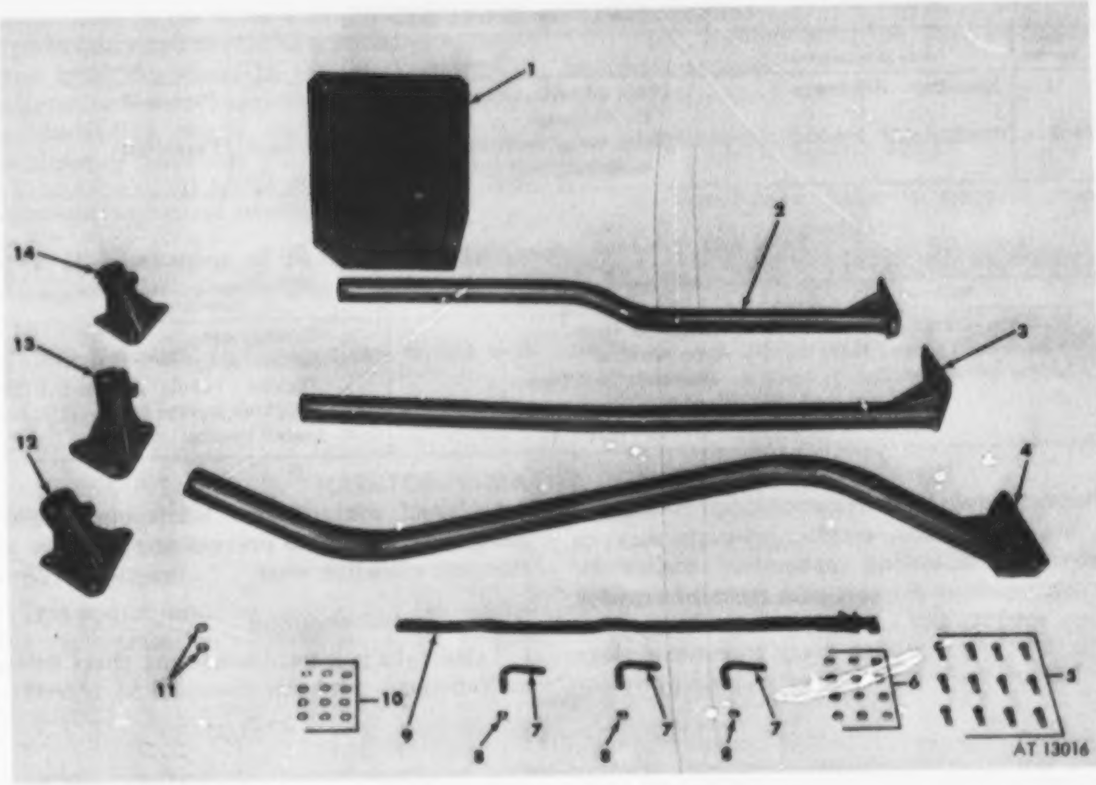
This section contains instructions for service and replacement procedures for those components of the machinegun mount kit (fig. 3-37) which are allocated to organizational maintenance personnel. These components are: the leg anchor handles and attaching hardware.

3-49. Tabulated Data

Part number	11600510
Height (overall)	63 in.
Material:	
Mounting legs	Steel tubing, 2½ in. OD, 7/32-in. wall thickness
Mounting sockets	Corrosion resisting steel tubing, 3 in. OD, 7/32-in. wall thickness
Gunner's platform	Aluminum abrasive-tread plate 3/16-in. thick

3-50. Service Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-51.



1—Platform assembly
2—Leg assembly
3—Leg assembly
4—Leg assembly
5—Capscrew (12)
6—Nut (12)
7—Handle
8—Jamnut
9—Strap
10—Lockwasher (12)
11—Flat washer
12—Socket assembly
13—Socket assembly
14—Socket assembly

Figure 3–37. Machinegun mount kit, reference view.

3–51. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed in order that defects may be detected and corrected before damage or failure results. Any defects or improper operation beyond the scope of the operator or organizational maintenance personnel must be reported to direct support maintenance.

b. Table 3–11 lists preventive-maintenance services to be performed before and after firing the mounted weapon and before the vehicle travels.

c. Lubrication of the installed machinegun mount kit consists of cleaning and oiling moving parts specified in TM 9–2016. Use lubricating oil, PL Medium, where moderate temperature (above 32°F), humidity, and atmospheric conditions prevail. Use lubricating oil, PL Medium, where moderate temperature (above 32° F.), humidity, and atmospheric conditions prevail. Use lubricating oil, PL Special, where expected temperature is below 32° F. Reduce the service interval and lubricate as necessary to compensate for abnormal or extreme operating conditions such as: high or low temperatures, continued operation in sand or dust, or exposure to high humidity or rain.

Table 3-11. Preventive-Maintenance Checks and Services for Machinegun Mount Kit

ORGANIZATIONAL SEMIANNUAL SCHEDULE

Item number	Item to be inspected	Procedure	Reference
1	Mounting Hardware	Check all bolts, nuts, and attaching parts for tightness.	Para 3-53
2	Strap	Check strap securing co-driver's seat back to seat support for tightness.	Para 3-53*a*

Table 3-12. Troubleshooting—Machinegun Mount Kit

Malfunction	Probable causes	Corrective action
1. Platform assembly not level. when hand control valve is	*a.* Strap not tight. *b.* Strap broken.	*a.* Tighten strap. b. Replace strap.
2. Leg(s) loose in socket(s).	*a.* Handle jamnut loose. *b.* Missing handle.	*a.* Tighten handle in socket and tighten jamnut. *b.* Install handle.

During periods when the machinegun mount kit is not being used, service intervals may be extended, depending upon the shelter or protection from the elements given to the M49 ring mount and carriage assembly. After operations in sandy or dusty conditions, clean and inspect all surfaces and moving parts for fouled and contaminated lubricants; relubricate, as necessary, to prevent any abrasive action and excessive wear.

3-52. Troubleshooting

Table 3-12 is a troubleshooting chart listing malfunctions, probable causes, and corrective

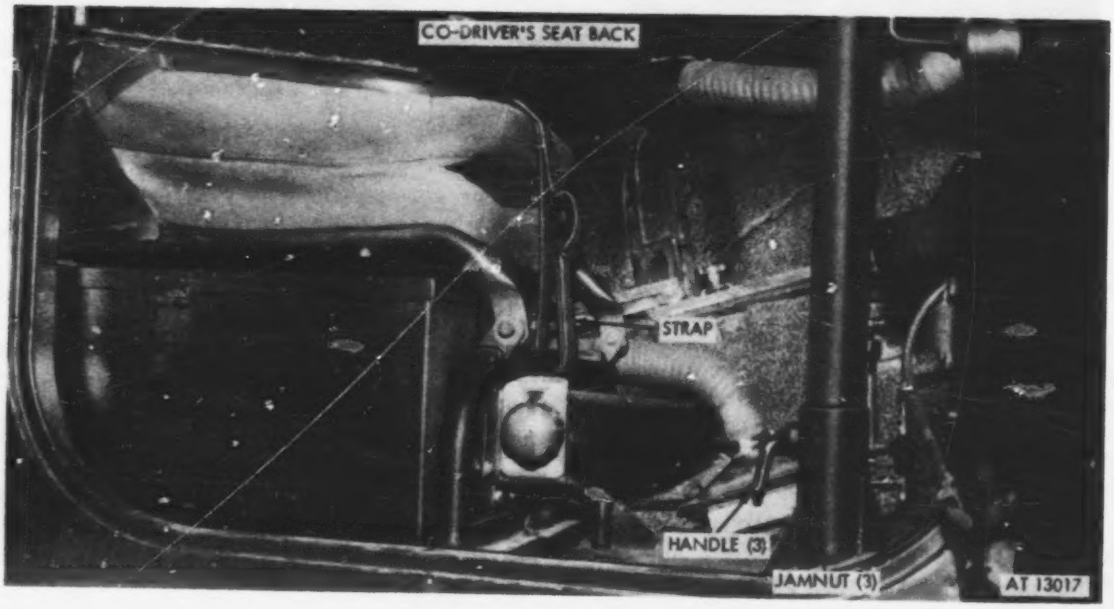


Figure 3-38. Machinegun mount strap and handles.

actions to be taken. The sequence of probable causes listed in the table is given in the order of probability and should be considered as such when troubleshooting. In the event that any malfunction occurs which is not covered in the troubleshooting chart, notify direct support maintenance personnel.

Note. Refer to TM 9-2016 for information on M49 ring mount and carriage assembly.

3-53. Replacement of Machinegun Mount Kit Components (Fig. 3-38)

a. Strap.

(1) *Removal.* Unfasten strap buckle and remove strap.

(2) *Installation.*

(*a*) Refer to removal instructions and reverse sequence.

(*b*) Tighten strap so that co-driver's seat back is level.

b. Handle.

(1) *Removal.* Loosen jamnut and remove handle.

(2) *Installation.* Refer to removal procedure and reverse sequence.

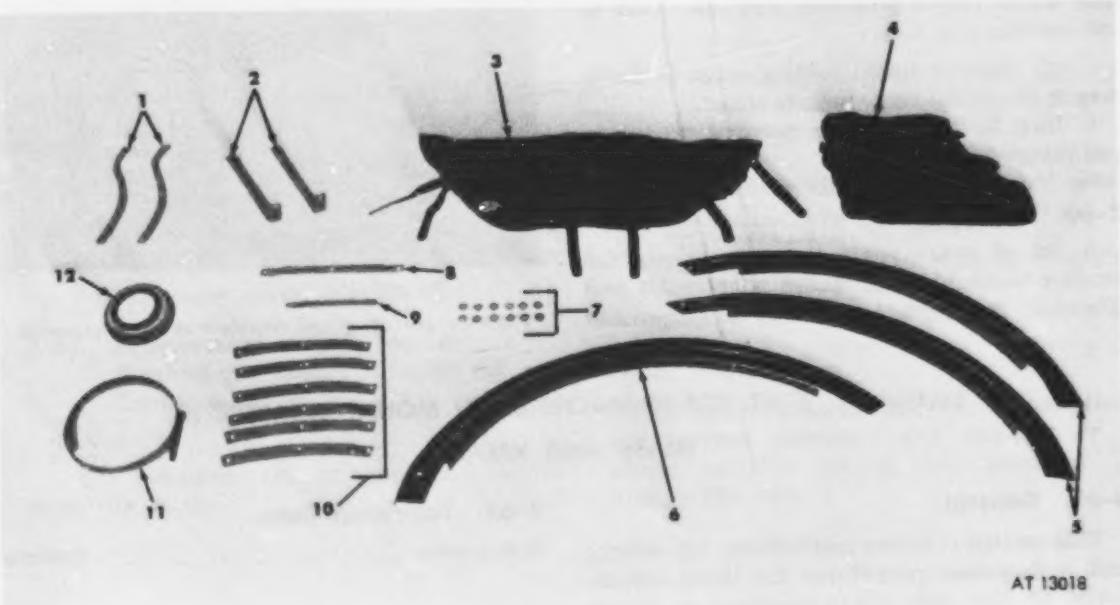
3-54. Parts List

Repair parts for the machinegun mount kit allocated for replacement by organizational maintenance personnel are listed in TM 9-2320-230-20P.

Section X. HARDTOP-TO-MACHINEGUN MOUNT ADAPTER KIT (M656 AND XM757)

3-55. General

This section contains instructions for service and replacement procedures for those components of the hardtop-to-machinegun mount adapter kit (fig. 3-39) which are allocated to organizational maintenance personnel. These



1—Retainer
2—Retainer
3—Cover assembly
4—Cover assembly
5—Collar
6—Collar
7—Flat washer (12)
8—Retainer
9—Retainer
10—Retainer (6)
11—Clamp
12—Seal

Figure 3-39. Handtop-to-machinegun mount adapter kit, reference view.

components are: the two cover assemblies, the clamp and the kit's attaching hardware.

3-56. Tabulated Data

Part number	11600607

3-57. Services Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-58.

3-58. Preventive-Maintenance Services

See chapter 2 of this manual for general preventive-maintenance services applicable to the hardtop-to-machinegun mount adapter kit.

3-59. Replacement of the Hardtop-To-Machinegun Mount Adapter Kit Components

a. Removal.

(1) Remove top cover by loosening six straps (fig. 3-40).

(2) Remove 28 screws, lockwashers, and nuts which fasten nine retainers and cover to cab hardtop (fig. 3-41).

(3) Remove clamp holding cover to machinegun mounting ring; remove cover.

b. Installation. Refer to removal procedure and reverse sequence.

3-60. Parts List

A list of spare parts and components for hardtop-to-machinegun mount adapter kit and allocated for replacement by organizational maintenance personnel is in TM 9-2320-230-20P.

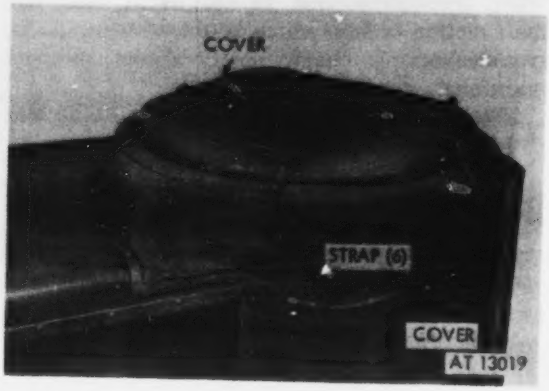


Figure 3-40. Hardtop-to-machinegun mount adapter covers.

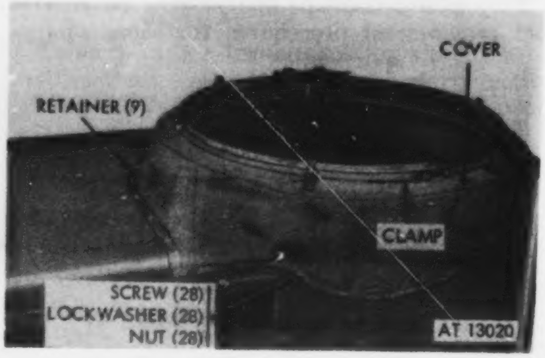


Figure 3-41. Clamp and retainers on cover assembly.

Section XI. SOFT TOP-TO-MACHINEGUN MOUNT ADAPTER KIT (M656 AND XM757)

3-61. General

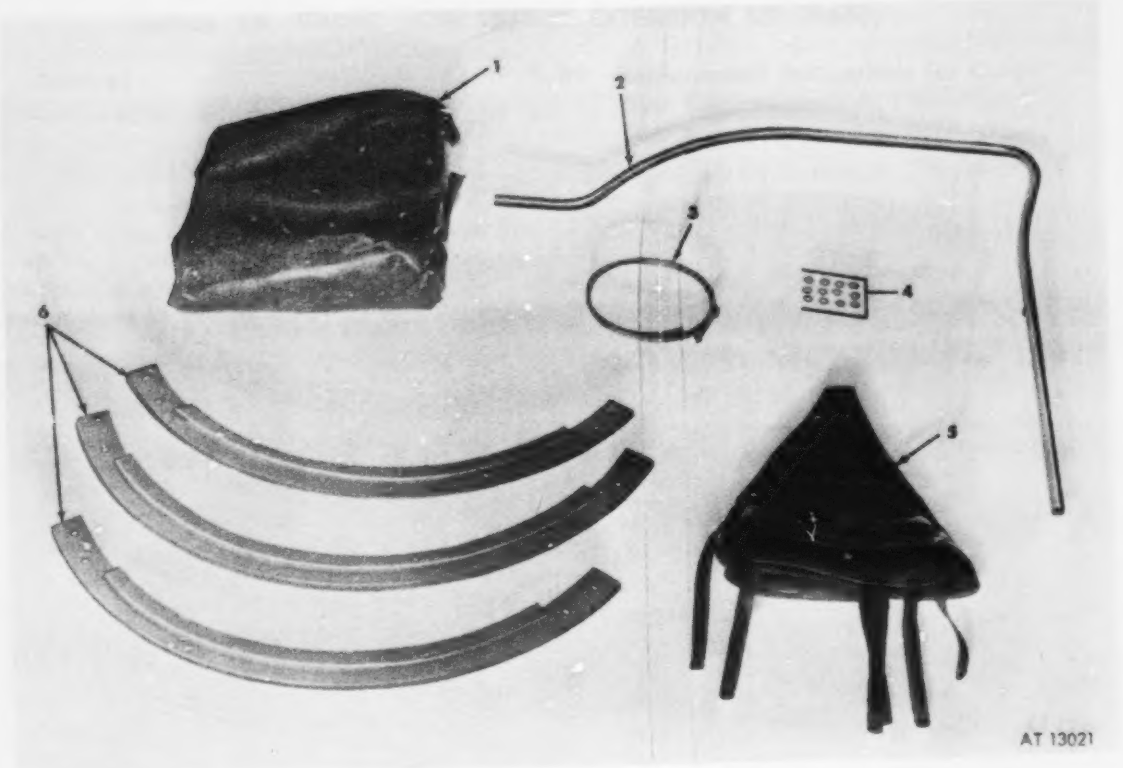
This section contains instructions for service and replacement procedures for those components of the soft top-to-machinegun mount adapter kit (fig. 3-42) which are allocated to organizational maintenance personnel. These components are: the cover assembly and the clamp.

3-62. Tabulated Data

Part number	11600608

3-63. Service Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and/or serviced as prescribed in paragraph 3-64.



1—Roof assembly
2—Bow assembly
3—Clamp
4—Flat washer (12)
5—Cover
6—Bow

Figure 3-42. Soft top-to-machinegun mount adapter kit, reference view.

3-64. Preventive-Maintenance Services

See chapter 2 of this manual for general preventive-maintenance services of the soft top-to-machinegun mount adapter kit.

3-65. Replacement of Soft Top-To-Machinegun Mount Adapter Kit Components

a. Removal.

(1) Unfasten six straps and remove cover (fig. 3-43).

(2) Remove clamp retaining roof assembly on machinegun mount ring (fig. 3-44).

b. Installation. Refer to removal procedure and reverse sequence.

3-66. Parts List

The spare parts allocated to organizational maintenance personnel and removed or replaced in this section are listed in TM 9-2320-230-20P.

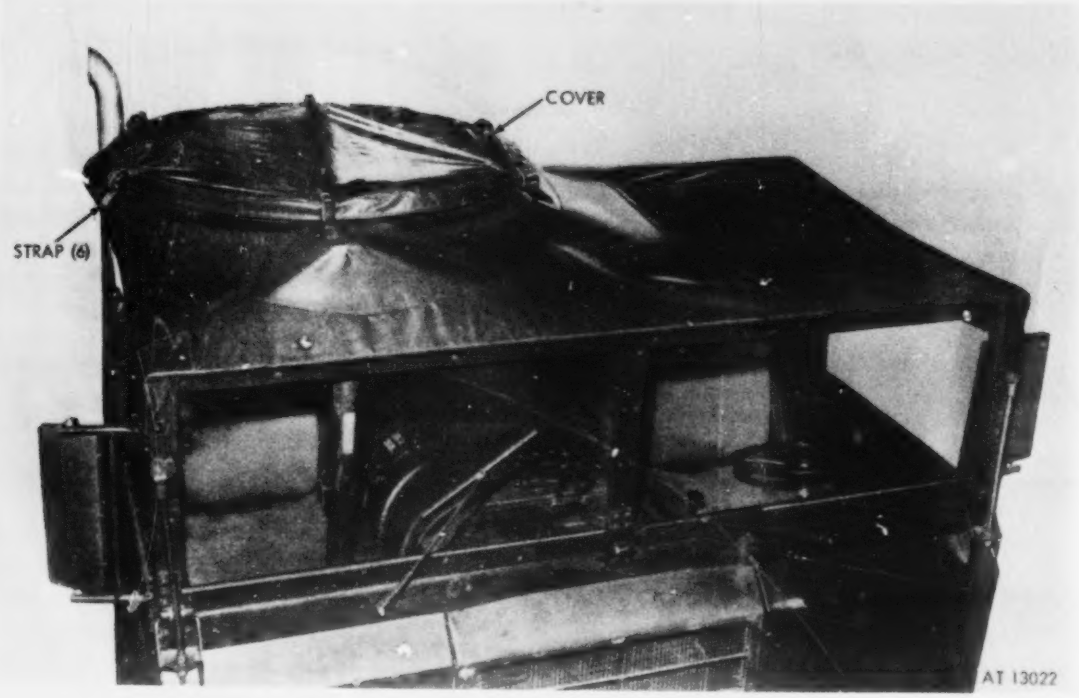

COVER
STRAP (6)
AT 13022

Figure 3-43. Soft top-to-machinegun mount adapter kit, installed view.

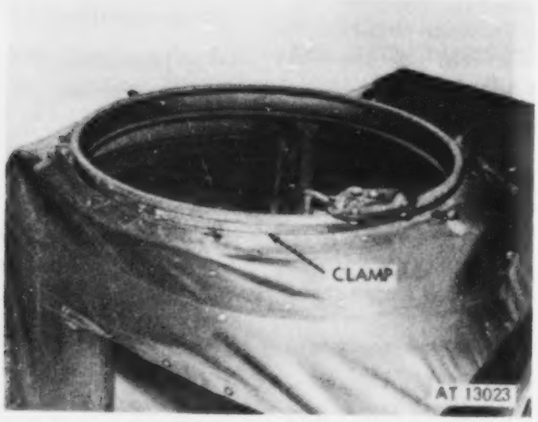

CLAMP
AT 13023

Figure 3-44. Soft top-to-machinegun mount kit clamp.

Section XII. CARGO BOW HEIGHT EXTENSION KIT (M656)

3–67. General

This section contains instructions for service and replacement procedures for those components of the cargo bow height extension kit (fig. 3–45) which are allocated to organizational maintenance personnel. These components are: the vehicle and heater exhaust extension pipes, a coupling clamp gasket and attaching hardware.

3–68. Preventive-Maintenance Services

There are no corrective services for the cargo bow height extension kit. Repair consists of replacement of parts.

3–69. Replacement Instructions for Cargo Bow Height Extension Kit Components

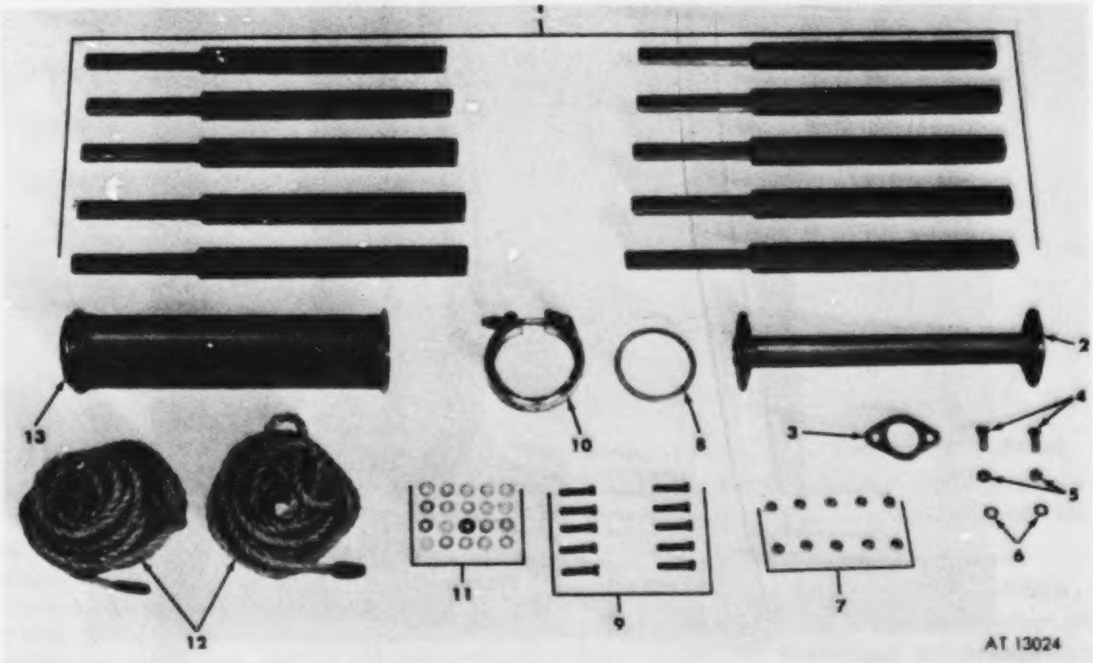
a. Vehicle Exhaust Extension (*Fig. 3–46*).

(1) *Removal.*

(*a*) Remove three nuts, lockwashers, and capscrews (1) securing two clamps (2) to vehicle and personnel heater upper exhaust pipes (6 and 3). Remove clamps.

Note. This step is not necessary for vehicles without cold weather or arctic kits.

(*b*) Remove clamp (8) securing vehicle upper exhaust pipe (6) to exhaust pipe exten-



1—Extension (10)
2—Heater exhaust extension
3—Gasket
4—Capscrew
5—Lockwasher
6—Flat washer
7—Nut (10)
8—Gasket
9—Capscrew (10)
10—Clamp
11—Flat washer (20)
12—Tarpaulin tie-down rope
13—Engine exhaust extension

Figure 3–45. Cargo bow height extension kit, reference view.

sion (10). Remove upper exhaust pipe and gasket (9). Discard gasket.

(*c*) Remove clamp (11) securing vehicle exhaust pipe extension (10) to intermediate exhaust pipe (13). Remove exhaust pipe extension and gasket (12). Discard gasket.

(2) *Installation*. Refer to removal procedure and reverse sequence.

b. Personnel Heater Exhaust Extension (Fig. 3-46).

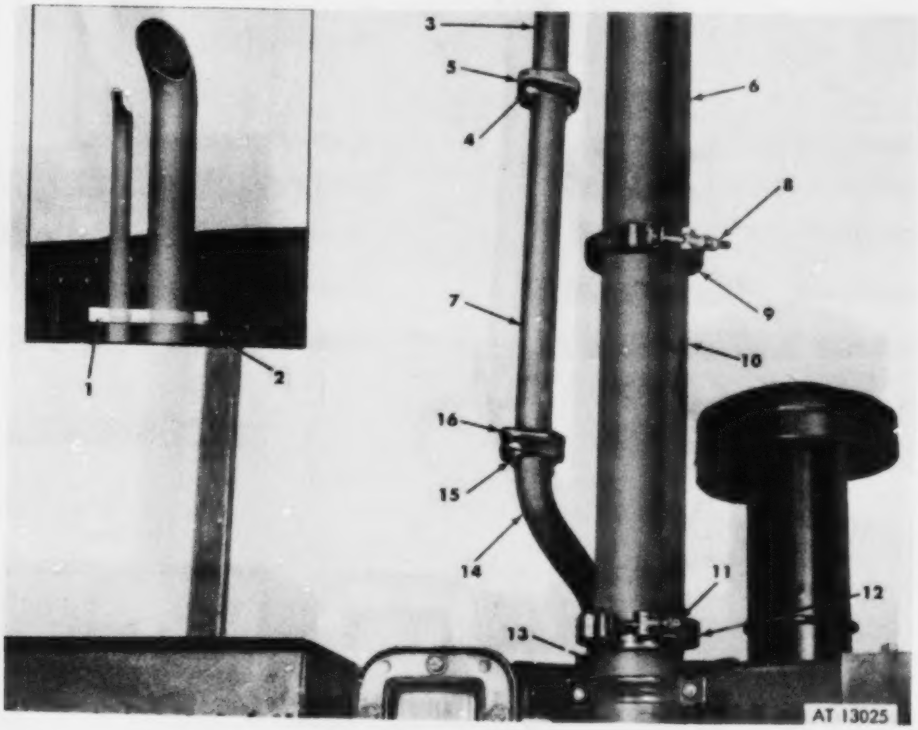
(1) *Removal.*

(*a*) Remove three nuts, lockwashers, and capscrews (1) securing two clamps (2) to vehicle and personnel heater upper exhaust pipes (6 and 3). Remove clamps.

(*b*) Remove two nuts, lockwashers, and capscrews (4) securing heater upper exhaust pipe (3) to exhaust pipe extension (7). Remove upper exhaust pipe and gasket (5). Discard gasket.

(*c*) Remove two nuts, lockwashers, and capscrews (15) securing heater exhaust pipe extension (7) to intermediate exhaust pipe (14). Remove exhaust pipe extension and gasket (16). Discard gasket.

(2) *Installation*. Refer to removal procedure and reverse sequence.



1—Capscrew (3)
Lockwasher (3)
Nut (3)
2—Clamp (2)
3—Heater upper exhaust pipe
4—Capscrew (2)
Lockwasher (2)
Nut (2)
5—Gasket (hidden)
6—Vehicle upper exhaust pipe
7—Heater exhaust pipe extension
8—Clamp
9—Gasket (hidden)
10—Vehicle exhaust pipe extension
11—Clamp
12—Gasket (hidden)
13—Vehicle intermediate exhaust pipe
14—Heater intermediate exhaust pipe
15—Capscrew (2)
Lockwasher (2)
Nut (2)
16—Gasket (hidden)

Figure 3-46. Vehicle and heater exhaust extensions.

c. Tarpaulin Tie-Down Ropes (Fig. 3-47).

(1) *Removal.* Untie stopper knots on ends of ropes. Remove ropes.

(2) *Installation.* Refer to figure 3-47 for lacing pattern and install ropes. Tighten ropes and tie stopper knots in ends.

3-70. Parts List

Cargo bow height extension spare kit parts allocated for organizational maintenance are listed in TM 9-2320-230-20P.

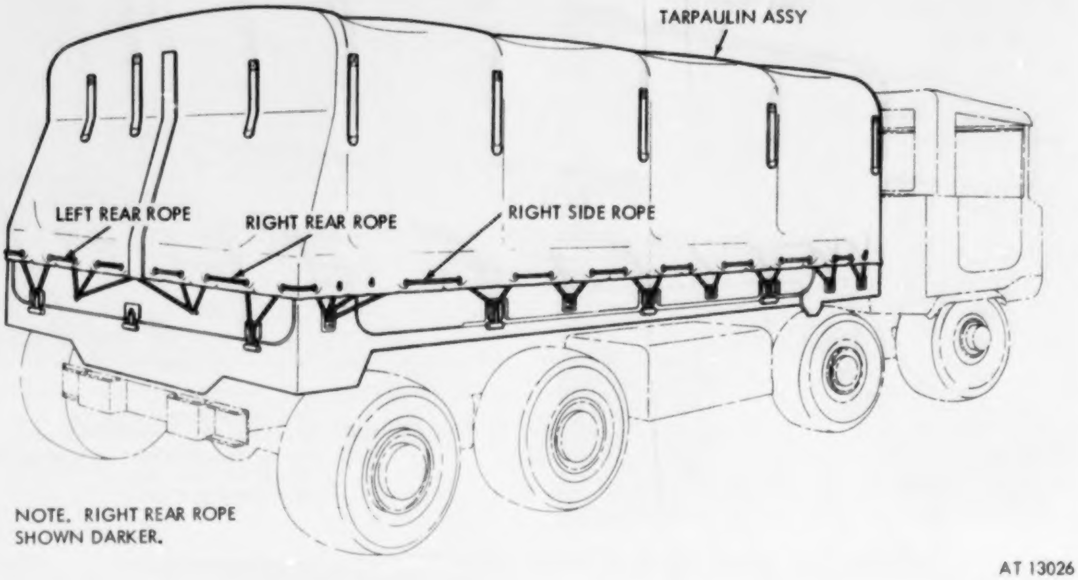


Figure 3-47. Tarpaulin tie-down ropes, lacing pattern.

Section XIII. VEHICLE SLINGING KIT

3-71. General

This section contains instructions for service and replacement procedures for those components of the vehicle slinging kit (fig. 3-48) which are allocated to organizational maintenance personnel. These components are: the lifting eyes, retracting mechanism and cable guides for M656 and XM791 vehicles without winch, and cable guides only for XM757 vehicle without winch. Kits for vehicles with winch omit cable guides.

3-72. Tabulated Data

Part number:

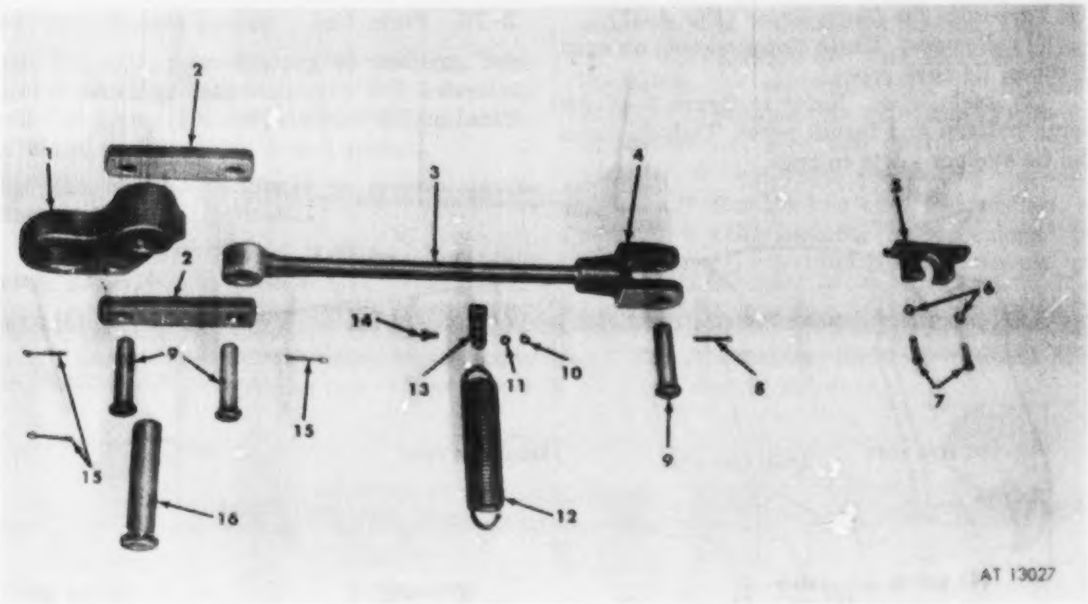
XM791 and M656, without winch	11600512-1
XM791 and M656, with winch	11614130
XM757, without winch	11600512-2

3-73. Service Upon Receipt of Materiel

Materiel received for maintenance or repair must be checked and serviced as prescribed in paragraph 3-74.

3-74. Preventive-Maintenance Services

a. A systematic inspection at regular intervals should be performed by organizational maintenance personnel in order that defects may be detected and corrected before damage or failure results, and to determine that operator and crew maintenance is being performed. Any defects or improper operation beyond the scope of organizational maintenance personnel must be reported to direct support maintenance.



1—Lifting eye (2)
2—Shackle (4)
3—Retracting bar (2)
4—Clevis (2)
5—Cable guide (2)
6—Lockwasher
7—Capscrew
8—Cotter pin (2)
9—Clevis pin (2)
10—Nut (2)
11—Lockwasher (2)
12—Retracting spring (2)
13—Clip (2)
14—Capscrew (2)
15—Cotter pin (2)
16—Clevis pin (2)

Figure 3-48. Vehicle slinging kit (M656 and XM791 w/o winch), reference view.

b. Table 3-13 lists preventive-maintenance services to be performed or supervised by organizational maintenance personnel.

3-75. Replacement of Vehicle Slinging Kit Components

a. Cable Guide (All Vehicles W/O Winch).

(1) *Removal (fig. 3-49).* Remove two capscrews and lockwashers securing cable guide to front of cab. Remove cable guide.

(2) *Installation.* Refer to removal procedure and reverse sequence.

b. Retracting Mechanism Spring and Clevis Pins (M656 and XM791).

(1) *Removal (fig. 3-50).*

(*a*) With retracting mechanism in retracted position, remove spring from between clip and frame bracket.

Table 3-13. Preventive-Maintenance Checks and Services for Vehicle Slinging Kit Equipped Vehicles

ORGANIZATIONAL SEMIANNUAL SCHEDULE			
Item number	Item to be inspected	Procedure	Reference
1	Pin Connections	Check for free movement of all pinned connections.	Para 3-75
2	Shackles or Bars	Check for bent shackles or bars.	Para 3-75*b*
3	Lifting Eye	Check for clearance between lifting eye and cargo box with eye in lifting position. Check for full retraction of lifting eye. Adjust spring clip position if necessary.	Para 3-75*b*

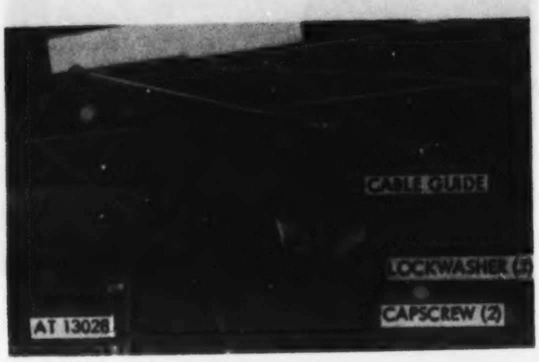

CABLE GUIDE
LOCKWASHER (2)
CAPSCREW (2)
AT 13028

Figure 3-49. Cable guide, all vehicles w/o winch.

(*b*) Remove nut, lockwasher, and capscrew securing clip to bar. Remove clip.

(*c*) Remove cotter pins retaining clevis pins. Drive out clevis pins. Discard cotter pins.

(2) *Installation.* Refer to removal procedure and reverse sequence.

3-76. Parts List

For a list of repair parts used in the vehicle slinging kit and allocated to organizational maintenance personnel, refer to TM 9-2320-230-20P.

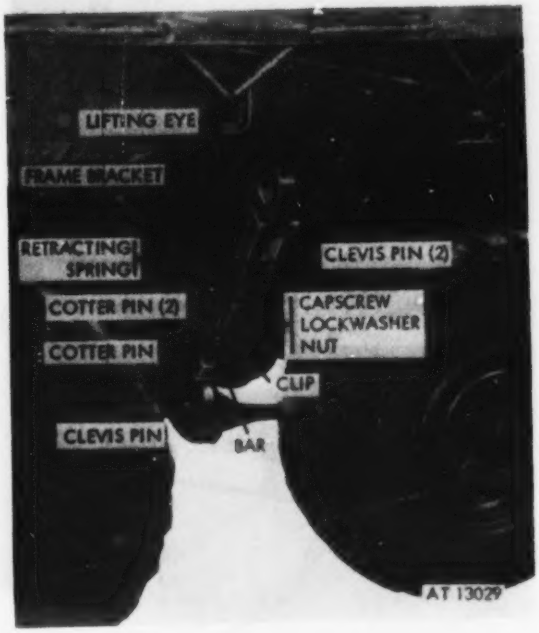

LIFTING EYE
FRAME BRACKET
RETRACTING SPRING
CLEVIS PIN (2)
COTTER PIN (2)
CAPSCREW
LOCKWASHER
NUT
COTTER PIN
CLIP
CLEVIS PIN
BAR
AT 13029

Figure 3-50. Retracting mechanism spring and clevis pins.

Section XIV. TAILGATE SUPPORT KIT (M656)

3-77. General

This section contains instructions for service and replacement procedures for the tailgate support kit (fig. 3-51).

3-78. Tabulated Data

Part number	11639628

3-79. Preventive Maintenance and Troubleshooting

When the tailgate support assembly is found to be defective it must be replaced.

3-80. Tailgate Support Assembly, Removal and Installation

a. Removal (Fig. 3-52).

(1) Slide shaft attachment of tailgate support out of slot in side panel.

(2) Remove eye on cable from hook on tailgate.

b. Installation. Refer to removal procedure and reverse sequence.

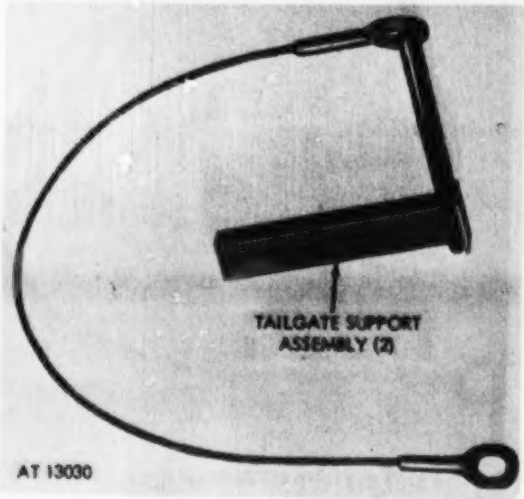


Figure 3-51. Tailgate support kit, reference view.

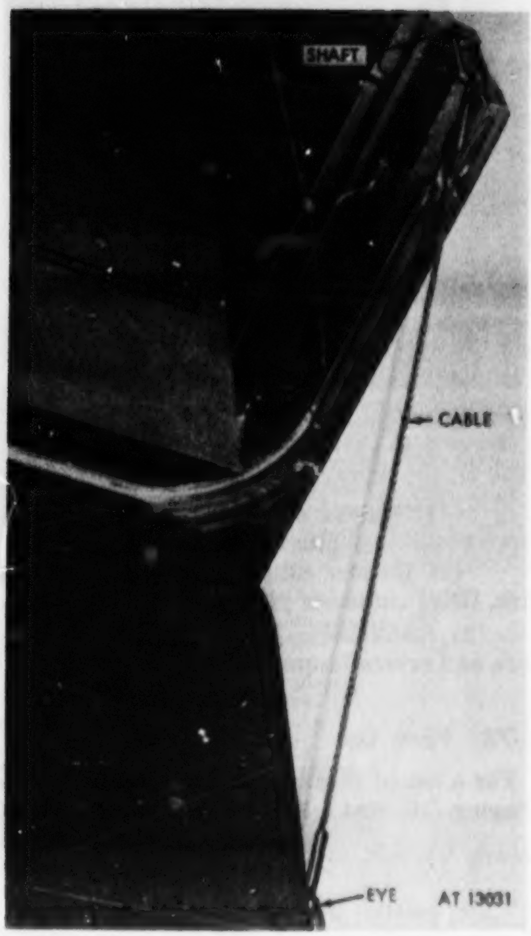


Figure 3-52. Tailgate support kit, installed view.

Section XV. SEAT BELT KIT

3-81. General

This section contains instructions for service and replacement procedures for those components of the seat belt kit which are allocated to organizational maintenance personnel. These components are: two belts and attaching hardware.

3-82. Tabulated Data

Part number	11639622

3-83. Preventive-Maintenance Services

Below is a list of preventive-maintenance services to be performed or supervised by organizational maintenance personnel.

a. Check all belts to determine that there is no fraying or signs of wear.

b. Inspect attaching hardware to insure that seat belts are well fastened to frame of seat.

3-84. Troubleshooting

There is no troubleshooting of the seat belt kit. If a defect is found, kit must be replaced.

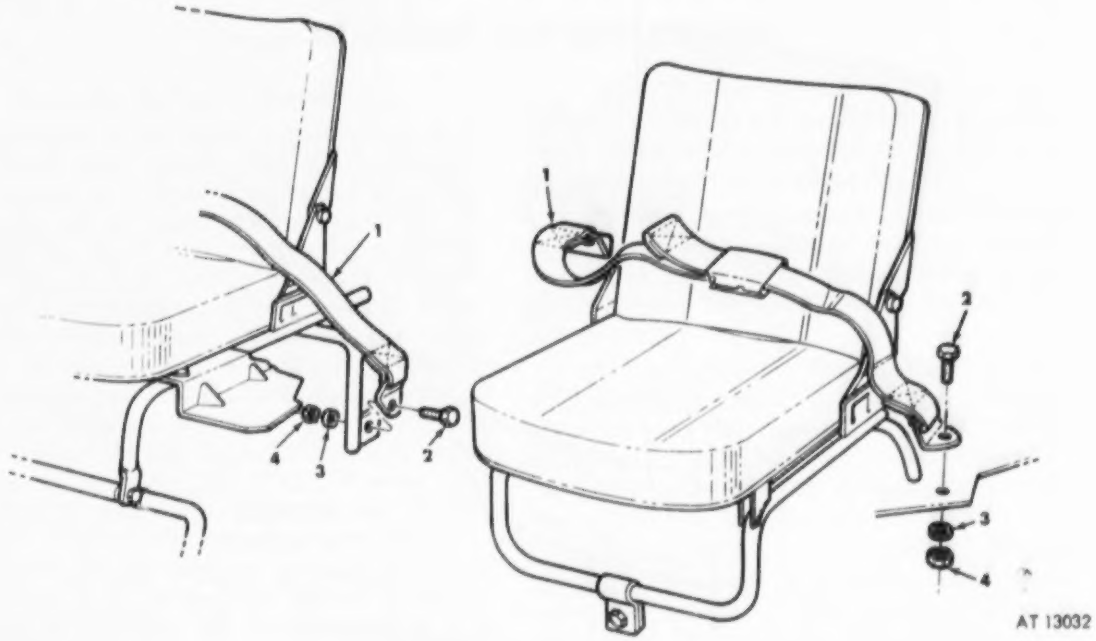
3-85. Maintenance Instructions for Replacement of Seat Belt Kit

a. Removal (Fig. 3-53). Remove two screws, flat washers, and nuts on seat belt assembly and remove belt.

b. Installation. Refer to removal procedure and reverse sequence.

3-86. Parts List

A list of the spare parts included in the seat belt kit and allocated to organizational maintenance personnel is found in TM 9-2320-230-20P.



1—Seat belt assembly
2—Capscrew (2)
3—Flat washer (2)
4—Nut (2)

Figure 3-53. Seat belt kit, exploded view.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

4-1. Domestic Shipping Instructions

a. Preparation for Shipment in Zone of Interior. When shipping the 5-ton, 8 x 8, M656 series vehicles, the officer in charge of preparing shipment will be responsible for furnishing vehicles to the carriers for transport in a serviceable condition, properly cleaned, preserved, painted, and lubricated as prescribed in MIL-V-62038. Preservation and other protective measures taken in the preparation of vehicles and accompanying tools and equipment for shipment must be sufficient to protect the materiel against deterioration and physical damage during shipment MIL-V-62038 prescribes specific procedures for shipment and limited storage. General procedures are listed below.

(1) *Cleaning.* Prior to application of preservatives, surfaces must be cleaned to insure removal of corrosion, soil, grease, residues, and fingerprints, perspiration, or other acid and alkali residues.

(*a*) *Interior of vehicle.* Remove all dirt and other foreign matter from all unpainted metal surfaces of the vehicle by scrubbing with cloths soaked in dry-cleaning solvent or mineral spirits paint thinner. Do not apply solvent to electrical equipment or rubber parts of any nature. Use warm water for cleaning rubber parts.

Warning: **Cleaning fluids are flammable and toxic. Keep them away from sparks and open flame. Use only in well-ventilated area and avoid prolonged inhalation of fumes or skin contact with fluids. Wear synthetic rubber gloves and protective clothing and goggles.**

Caution: **Do not use liquids under pressure for cleaning interior of vehicle.**

(*b*) *Exterior of vehicle.* Exterior surfaces of the vehicle will be cleaned in a manner which will insure removal of all foreign matter, including excess cleaning material.

(2) *Drying.* Immediately after cleaning parts must be thoroughly dried to remove cleaning solutions or residual moisture by ambient air or by wiping with clean, dry, lint-free cloths.

(3) *Lubrication.* After cleaning has been accomplished, all grease fittings must be wiped clean with dry-cleaning solvent and the vehicle lubricated in accordance with LO 9-2320-230-12. Excess grease must be removed after lubrication and before processing.

(4) *Preservation.* All critical unpainted metal surfaces must be protected during shipment. Use procedures and materials listed in (*a*) and (*b*) below. If the preservatives listed below are not available, oil or grease covered in LO 9-2320-230-12 may be used for this purpose, but it is effective for only a few days; therefore, equipment so protected must be closely watched for signs of corrosion. Selection of preservatives shall be such that their application, use or removal will not damage the surface to which they are applied.

(*a*) *Battery leads.* Each battery lead terminal, including the jumper lead ends, shall be cleaned, coated with type GAA automotive and artillery grease, and wrapped with pressure-sensitive adhesive tape. Jumper leads shall then be taped to the battery-to-ground lead to avoid loss.

(*b*) *Miscellaneous preservation.* All unpainted, machined metal surfaces on the inside of the vehicle shall be coated with type GAA automotive and artillery grease. All unpainted, exposed, machined metal surfaces on the exterior of the vehicle, shall be coated with corrosion-preventive compound.

1. Lenses. Cover all vehicle lamp lenses with grease-proof barrier-material and secure with pressure-sensitive adhesive tape.

2. Electrical openings. Cover all open electrical receptacles with pressure-sensitive adhesive tape, or with plastic caps which will afford the same degree of protection.

(*c*) *Tires.* Increase tire pressure slightly higher than normal except where shipment is to be exposed to extremely hot-weather conditions.

(*d*) *Toolboxes.* If vehicle is equipped with steel toolboxes, remove all padlocks and keys to prevent pilferage in transit. Secure lids of steel toolboxes by wiring the hasp to prevent damage. Preserve padlocks and keys with preservative engine oil (grade I) and wrap in greaseproof barrier material for domestic shipment or seal in a waterproof-greaseproof wrapping to bag for oversea shipment. Locate all wrapped padlocks and keys in the shipping container with the accessories.

b. Preparation of On-Vehicle Equipment (OVE).

(1) *General.* Preserve and package all OVE individually, except items used as sets or in quantities greater than one.

(2) *Battery and electrolyte.*

(*a*) If vehicle is to be shipped within the continental United States, except direct to port of embarkation, disconnect the battery cables brom battery, clean if necessary ((*b*) below), and wrap cable terminals and battery posts with nonhygroscopic adhesive tape. Secure terminals away from battery.

(*b*) If vehicles are to be shipped direct to ports of embarkation, except when vehicles are to be combat loaded, remove batteries, plug vents, and clean outside of batteries with a solution containing one-half pound of commercial grade baking soda (sodium bicarbonate) to one gallon of water. Rinse with cool water and remove vent plugs. Scrape or wire-brush and clean cable terminals and battery box (holder) with above cleaning solution. Rinse with cool water. Coat cable terminals with artillery and automotive grease (GAA). Paint battery boxes, if required, with black acid-resisting paint. Battery and electrolyte will be packed in accordance with MIL-S-207 and shipped in vehicle separate from other OVE.

(3) *Publications.* Package technical manuals in accordance with Method 1C-3, "Waterproof bag, sealed," using heavy-duty, type 1, heatsealable, grade A, waterproof class b bags. Pack in the OVE container. Where publications are provided by separate technical services, such material will be packed in the same exterior OVE container with the items to which they are applicable.

(4) *Unit packages.* Unit packages that are impracticable to intermediate package and are not water resistant in construction will be overwrapped in flexible waterproof barrier material and sealed with waterproof water-resistant adhesive.

(5) *Intermediate packages.* Unit packages of related items will be grouped together wherever possible and intermediate packaged in fiberboard cartons. Container closure will be made by sealing all seams with water-resistant gummed paper tape. When the gross weight exceeds 20 pounds, in addition to sealing with tape, the containers will be sealed with water-resistant adhesive (for sealing fiberboard boxes).

(6) *Exterior containers.*

(*a*) Keep the number of exterior containers to a minimum. The size will be governed by the cubic displacement of the packaged OVE. Dimensions will be such that when assembled in sets as required and stowed on vehicles, the overall cubage of the vehicle will not be increased and lifting devices will not be obstructed.

(*b*) Place heavy materiel or equipment in the bottom of exterior containers and block and brace as necessary so that they will not damage other contents. Pack fragile materiel, and canvas items above OVE items at the top of the container; in addition, pack canvas covers for OVE items in the same exterior container with the item for which it is intended.

(*c*) Pack unit and intermediate packages in style-2, unlined, snug-fitting, nailed wood boxes, for a type III load, or modified as prescribed in *1* through *5* below.

1. Exterior containers over 200 pounds' gross weight will have norminal 2 x 4 end cleats. Also, beveled end skids of nominal 2 x 4 lumber will be placed flat, parallel to the ends of the containers, and spaced approximately six (6) inches from each end, with span between skids not to exceed 36 inches.

2. The fastening of the skids to the bottom will be accomplished by the use of nails driven through the floor into the skid member. Nails will be of sufficient length and size to achieve maximum holding power.

3. Additional battens when required will be fastened to the inside faces of the top and side panels, and to the inside face of the bottom panel when skids are not required.

4. Construct the container top of matched lumber and nail to the side and end panels. The container will be weatherproofed, strapped and marked in accordance with MIL-P-116.

Note. Weatherproofing top of containers will not be necessary if containers are to be stowed within the vehicle.

5. Cover exterior surfaces of all OVE exterior containers (except tops) with one coat of olive-drab enamel.

Note. OVE containers stowed with the vehicle (cab or other protected location) will not require painting.

(7) *Stowage*.

(*a*) Stow all OVE containers inside the body, cab, or other suitable location, as applicable, without increasing the cubic displacement of the vehicle. Strap, block or brace all OVE containers to prevent free movement.

Note. OVE containers must receive maximum protection against corrosion, deterioration and mechanical damage during shipment and prolonged periods of storage.

(*b*) OVE containers constructed without skids that are to be stowed in exposed locations in contact with platforms, floors or other boxes will be placed on nominal 1 x 4 wood cleats to minimize surface contact. Secure cleats in a manner that will prevent shifting or damage to contacted surfaces.

(8) *Packing*. All spare parts, tools, equipment, and other loose items will be packaged and packed to prevent mechanical damage.

(9) *Marking*. Provide any necessary identification and precautionary markings in accordance with instructions contained in MIL-STD-129.

c. Army Shipping Documents. Prepare all Army shipping documents accompanying freight in accordance with TM 38-750.

d. Preparation for Shipment to Ports.

(1) *Inspection*. All used vehicles destined for oversea use will be processed, prior to shipment, in accordance with MIL-V-62038.

Note. Ports of embarkation will perform any necessary supplementary or previously omitted processing upon receipt of vehicle.

(2) *Marking of arctic-lubricated materiel*. It will be the responsibility of the officer in charge of the organization performing arctic lubrication to insure that the equipment is marked as prescribed in SR 746-30-10. It will be the responsibility of the officer in charge of the organization shipping arctic-lubricated equipment to insure that each item is so marked. Unit commanders of using organizations will insure that such marking are not obliterated while the equipment is arctic lubricated. When the equipment is deprocessed of the special lubrication, such marking will be immediately and thoroughly obliterated.

e. Army Shipping Documents. Prepare all Army shipping documents accompanying freight in accordance with TM 38-750.

4-2. Loading the 5-Ton, 8 x 8, M656 Series Vehicles

a. Method of Loading.

(1) *Rail shipment*. Loading of wheeled vehicles on open top single or multi-level railroad cars shall be in accordance with the applicable requirements of Section I, Association of American Railroads Rules, "Loading of Commodities on Open Cars" and the applicable figure of Section VI of the AAR rules, "Loading of Department of Defense Materiel on Open Top Cars." The quantity of units to be

loaded on each railcar, the type of railcar and the applicable transportation data shall be as authorized by the responsible Government transportation office.

Caution: **The height and width of vehicles, when prepared for rail transportation, must not exceed the limitations indicated by the loading table in AR 700-15 (sec II). Whenever possible, local transportation officers must be consulted about the limitations of the particular railroad lines to be used for the movement in order to avoid delays, dangerous conditions, or damage to equipment.**

(2) *Special equipment loading.* To facilitate loading to the full capacity of the transportation conveyance, cube reduction, disassembly, and preparation of the disassembled items shall be in accordance with the requirements MIL-V-62038.

(3) *Highway shipment.* Loading of vehicles for shipment by haulaway and rules for shipment by driveaway or towaway shall be in accordance with Interstate Commerce Commission Publication "Motor Carrier Safety Regulations" and applicable military publications.

(4) *Deck loading.* Vehicles shall be processed level A as specified in the Preservation Data Sheet for the specific item. Doors shall be secured to prevent accidental opening. All openings in closed cabs, vans, and other closed type bodies shall be sealed with tape conforming to MIL-T-43115. Radiator grilles shall be covered with a minimum 3/8 inch, three ply, plywood paneling bonded with exterior glue and secured with strapping conforming to type I, class B of QQ-S-781. Windows and fixed windshields shall be covered with minimum 3/8 inch, three ply, plywood paneling bonded with exterior glue and secured in place with strapping conforming to type I, class B of QQ-S-781. Fold-down windshields shall be protected as specified in MIL-V-62038.

b. Rail carriers are required to supply rail equipment in good working condition and with proper complement of tiedown chains and tensioning devices.

c. When vehicles are shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to the floor of flatcar as prescribed in paragraph 4-3.

d. Prepare all vehicles for rail shipment as prescribed in MIL-V-62038. On-vehicle equipment (OVE) will be thoroughly cleaned, preserved, packed (boxed or crated) and securely stowed in or on the vehicle.

e. When placing vehicle on flatcar, make sure there are no obstructions in the way to cause undercarriage interference.

f. Load vehicle in such a manner that it will not form an unbalanced load on flatcar. When loading more than one vehicle, all vehicles must face in same direction and be uniformly spaced.

g. Place transmission selector in "N" (neutral) position but do not apply handbrake after the vehicle has been finally spotted on the flatcar.

4-3. Blocking the 5-Ton, 8 x 8, M656, XM757, and XM791 Series Vehicle on Railroad Flatcars

a. General. All blocking instructions specified herein are minimum and are in accordance with Association of American Railroads Rules Governing the Loading of Commodities on Open Top Cars." Additional blocking may be added, as required, at the discretion of the officer in charge. Double-headed nails may be used, except in the lower piece of 2-piece cleats. Item reference letters given in *b* through *e* below refer to the details and locations in figures 4-1 and 4-2.

Note. Any loading instructions, regardless of source, which appear to be in conflict with this publication or existing loading rules of the carriers, must be submitted for approval to the Commanding General, U.S. Army Tank-Automotive Command, Attn: AMSTA-R, Warren, Michigan 48090.

b. Brake Wheel Clearance "A" (Fig. 4-1). Load trucks on flatcars, with a minimum clearance of at least four inches below and six inches above, behind, and to each side of the brake wheel. Any increase in clearance must be consistent with proper location of load.

c. Methods of Blocking. Two methods of blocking are given herein. The method to be used will depend on type and dimensions of flatcars. Method 1 (fig. 4-1) applies to a regular flatcar, and method number 2 (fig. 4-2) applies to a shock mitigated flatcar. These instructions are for vehicles single-loaded but two vehicles may be loaded on a 60 foot flatcar.

d. Method 1 (Fig. 4-1).

(1) *Chock blocks "B" (6 x 8 x 24 in.).* Sixteen blocks are required per vehicle and are constructed as shown in figure 4-3. Locate the 45-degree surface of blocks against the front and rear of each wheel. Stagger the blocks in a manner that will allow sufficient clearance on inside of each wheel. Nail heel of each block to car floor with 3 thirtypenny nails and toenail both sides of blocks to car floor and 1 thirtypenny nail each.

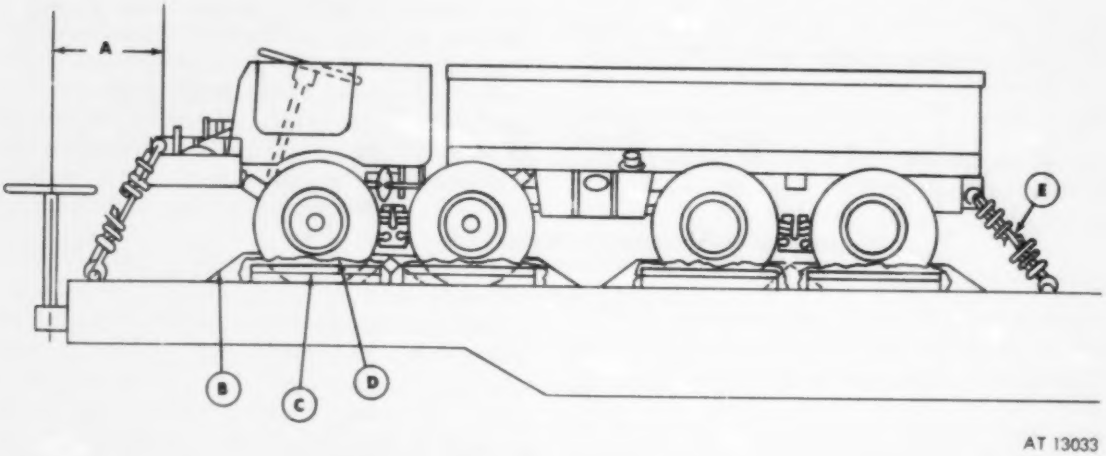


Figure 4-1. Method No. 1 of blocking the 5-Ton, 8 x 8, M656 series vehicles on regular railroad flatcars (typical).

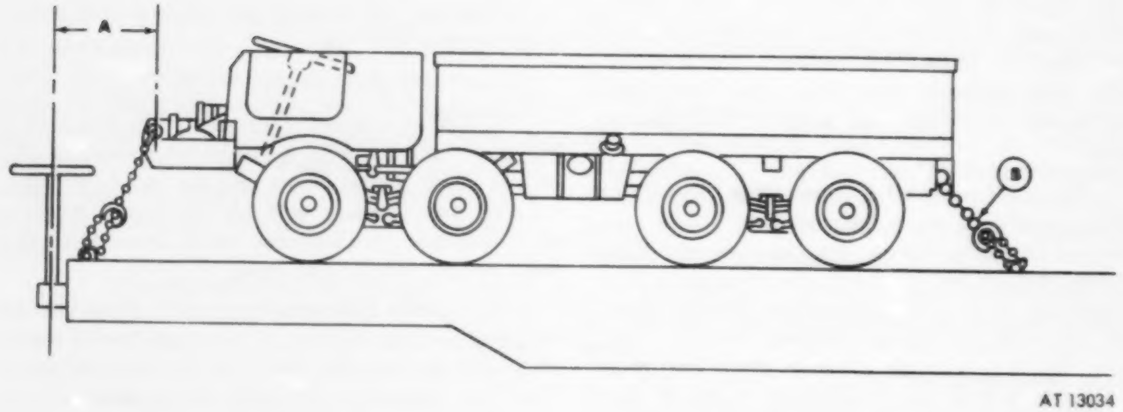
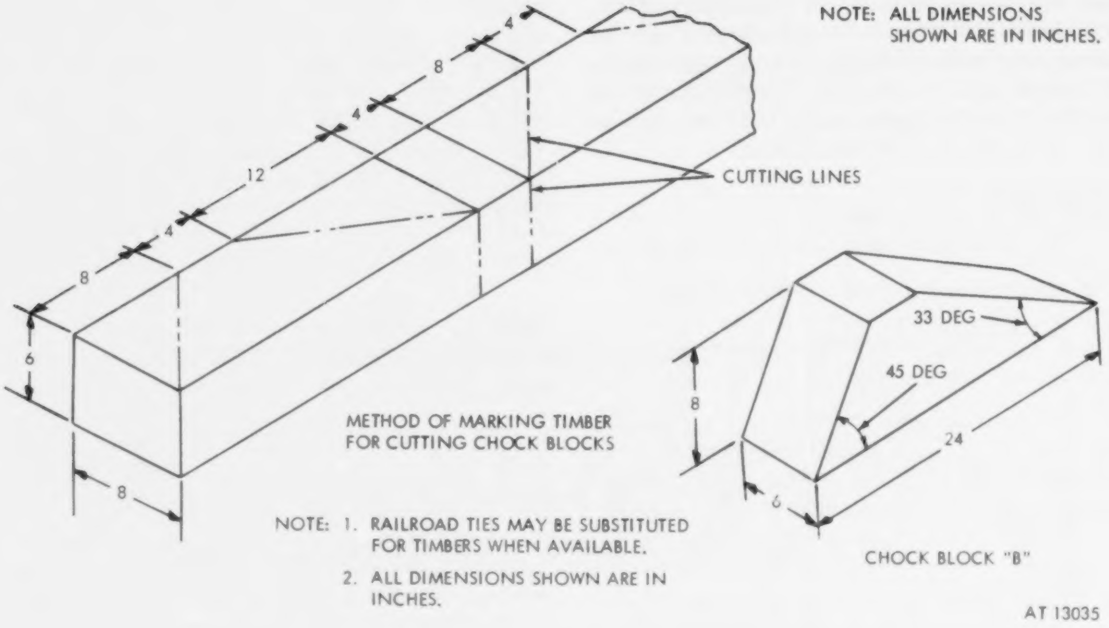


Figure 4-2. Method No. 2 of blocking the 5-Ton, 8 x 8, M656 series vehicles on shock mitigated railroad flatcars (typical).



NOTE: ALL DIMENSIONS SHOWN ARE IN INCHES.

NOTE: 1. RAILROAD TIES MAY BE SUBSTITUTED FOR TIMBERS WHEN AVAILABLE.
2. ALL DIMENSIONS SHOWN ARE IN INCHES.

Figure 4-3. Cutting chock blocks from timbers.

(2) *Wheel side cleats "C" (2 x 4 x 36 in.) and building paper "D" (10 x 36 in.)*. Sixteen cleats and eight pieces of building paper are required for each vehicle. Locate one cleat on flatcar floor against tire and place a piece of building paper between tire and cleat. Building paper must be placed so that it is under cleat and extends 2 inches beyond outside of cleat. Nail cleat to flatcar bed with 3 thirtypenny nails. Nail another cleat over the cleat that was nailed to flatcar bed with 3 thirtypenny nails.

(3) *Steel wire cable assemblies "E"*. Four cable assemblies, consisting of four 5/8-in. cables and 24 cable clamps, are required for each vehicle. Attach two cables to the front and two to the rear of vehicle lifting eyes. Attach other ends of cables to flatcar tiedown facility. Tiedowns must cross each other at front and rear of vehicle points of attachment down to the outboard flatcar tiedown facility. The angle of the tiedown should be approximately 35 degrees. Make sure tiedowns do not come in contact with electrical wiring or vehicle controls. Looped ends of cable must be free of kinks and overlapped at least 12 inches. Fasten one end of each cable with three cable clamps. Tighten each cable with a tensioning device and fasten cable with three cable clamps.

***Caution:* Cable must be replaced if it contains broken strands.**

e. Method 2 (Fig. 4-2).

(1) *Brake wheel clearance "A"*. Load vehicles on flatcars, with a minimum clearance of at least four inches below and six inches above, behind, and to each side of the brake wheel. Any increase in clearance must be consistent with proper location of load.

(2) *Chain tiedown device "B"*. Four chain tiedown devices having a minimum proof test of 26,000 pounds are required for each vehicle. Pass one chain through each clevis attached to front bumper and each clevis under rear bumperettes. Fasten other end of chain to flatcar tiedown device. Hand tension each chain as

tightly as possible and attach grab hook into appropriate link of tiedown chain. Make sure tiedowns do not come in contact with electrical wiring and vehicle controls. Final tensioning of tiedown chains will be accomplished by use of tensioning devices furnished by rail carrier. Tiedown chains will be secured parallel to each other at same end of the vehicle and placed so that chain angles will be approximately 45 degrees from the vehicle clevis to the flatcar tiedown device. Make sure chain is free of twisted, kinked, or badly worn links. After chains have been tensioned hit chains sharply to relieve any binding. Re-tension chains if necessary. Any open hooks must be secured with wire over the opening to prevent the hook from becoming disengaged from the chain during transit. Turnbuckles, when used to tighten chains, must be wired or locked to prevent turning during transit, unless turnbuckles are equipped with self-locking devices.

4-4. Limited Storage

a. General. Commanders are responsible for insuring that all vehicles issued or assigned to their command are maintained in a serviceable condition and porperly cared for, and that personnel under their command comply with technical instructions. Lack of time, lack of trained personnel, or lack of proper tools may result in a unit being incapable of performing maintenance for which it is responsible. In such cases, unit commanders may, with the approval of major commanders, place vehicle that is beyond the maintenance capability of the unit in limited storage or return it to supply agencies. When preparing the 5-ton, 8 x 8, M656 series vehicles for storage or for shipment, the unit commander will be responsible for processing the vehicle, including all tools and equipment, in such a manner as to protect them against corrosion, deterioration, and physical damage during periods of limited storage.

(1) Vehicles received for storage already processed for domestic shipment, as indicated on the DD Form 1397, must not be reprocessed unless the inspection performed on receipt of vehicles reveals corrosion, deterioration, etc.

(2) Completely process vehicle upon receipt direct from manufacturing facilities or if the processing data recorded on the tag indicates that preservatives have been rendered ineffective by operation or freight shipping damage.

b. Receiving Inspections. Immediately upon receipt of vehicles for storage, they must be inspected and serviced as prescribed in section I, chapter 2. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit and the vehicles will be inactivated for an appreciable length of time, store them in a limited-storage status and attach tags specifying the repairs needed. The reports of these conditions will be submitted by the unit commander for action by an ordnance maintenance unit.

c. Time Limitations. Limited storage is restricted to a period of 90 days and must not be extended unless the vehicle is reprocessed in accordnance with *d* below.

d. Storage Procedure. Disassembly will be limited to that necessary to clean and preserve surfaces. Except as otherwise noted, and to the maximum extent consistent with safe storage, the vehicle will be placed in limited storage in as nearly a completely assembled condition as practicable. Equipment will be installed and adjustments made so that the vehicle may be placed in service and operated with minimum of delay.

(1) The vehicle should be stored on level ground in the most favorable location available, preferably one which affords protection from exposure to the elements and from pilferage.

(2) Perform a "S" (seminannual) preventive-maintenance (PM) service on vehicles intended for limited storage. This maintenance will consist of inspecting, cleaning, servicing, preserving, lubrication, adjusting, and minor replacement of repair parts if required.

(3) Remove storage batteries and place in covered storage, maintaining a charged condition.

(4) Provide access to the vehicle to permit inspection, servicing, and subsequent removal from storage.

(5) Mark the vehicle "Limited Storage" (on windshield, tagged, or other convenient method). Vehicles so marked will not be operated while in this category.

e. Inspection in Limited Storage.

(1) Visual inspection of vehicles in limited storage must be conducted at least once each month and immediately following hard rains, heavy snowstorms, windstorms, or other severe weather conditions. Disassembly will be performed as necessary to ascertain fully the extent of any deterioration or damage found. A record of these inspections will be maintained for each vehicle in limited storage, attached to the vehicle in such a manner as to protect the record from the elements.

(2) When rust or deterioration is found on any unpainted area, necessary reprocessing for limited storage will be immediately accomplished. Damage caused to the vehicle by severe weather conditions will be promptly repaired. Deterioration or damage to on-equipment materiel (OEM) will be repaired as necessary. Painted surfaces showing evidence of deterioration will be thoroughly cleaned, dried and repainted, using paint of the same quality and color as the original paint.

f. Removal From Limited Storage.

(1) If the vehicles are not shipped or issued upon expiration of the limited-storage period, they will be further treated for standby storage by ordnance maintenance personnel.

(2) If vehicles to be shipped will reach their destination within the limited-storage period, they need not be reprocessed upon removal from storage, unless inspection reveals it to be necessary according to anticipated in-transit weather conditions.

(3) Deprocess vehicles when it has been ascertained that they are to be placed into immediate service. Remove all rust-preventive compounds and lubricate as prescribed in LO 9-2320-230-12. Inspect and service vehicles as prescribed in section I, chapter 2.

(4) Repair and/or replace all items tagged in accordance with *b*(3) above.

g. Storage Site. The preferred type of storage for vehicles is under cover in open sheds or warehouses, whenever possible.

Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

4-5. Refer to TM 9-2320-230-10,
Operator's Manual

APPENDIX A

REFERENCES

A-1. Publication Indexes and General References

Indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for the new publications relating to materiel covered in this technical manual.

a. Military Publication Indexes.

Index of Army Films, Transparencies, GTA Charts, and Recordings	DA Pam 108-1
Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Graphic Training Aids and Devices	DA Pam 310-5
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders	DA Pam 310-4
Index of Doctrinal Training, and Organizational Publications	DA Pam 310-3

b. General References.

Authorized Abbreviations and Brevity Codes	AR 320-50
Dictionary of United States Army Terms	AR 320-5
Military Symbols	FM 21-30
Military Training	FM 21-5
Techniques of Military Instruction	FM 21-6

A-2. Supply Manuals

The following Department of the Army Supply Manuals pertain to this materiel:

a. Demolition of Materiel to Prevent Enemy Use.

Explosives, Bulk, Propellants, and Explosive Devices	SM 9-5-1375
Land Mines and Components	SM 9-5-1345
Pyrotechnics, Military, All Types	SM 9-5-1370

b. Maintenance and Repair.

Tires and Tubes, Pneumatic	SM 9-1-2600
Tool Kit, General Mechanics (5180-754-0641)	SM 9-4-5180-A58
Tool Kit, Automotive Maintenance, Organizational: (2d echelon), Set No. 2, Common (5180-754-0650)	SM 9-4-5180-A20
Tool Kit, Automotive Maintenance, Organizational: (2d echelon), Set No. 2, Supplemental (4940-754-0743) (line item 453910)	SM 9-4-4940-A08
Tool Kit, Organizational Maintenance: (2d echelon), No. 1, Common (5180-754-0654)	SM 9-4-5180-A01
Tool Kit, Organizational Maintenance: Set A, Supplemental (5180-754-0653) (line item 453905)	SM 9-4-5180-A17

A-3. Forms

The following forms pertain to this materiel. (Refer to DA Pamphlet 310-2 for index of blank forms and to TM 38-750 for explanation on use.)

DA Form 2028, Recommended Changes to DA Publications
DA Form 2407-1, Maintenance Request—Continuation Sheet
DA Form 2408, Equipment Log Book Assembly—Instructions for General Equipment
DA Form 9-3, Processing Record for Shipment and Storage of Vehicles and Unboxed Engines
DD Form 1397, Processing and Deprocessing Records for Shipment, Storage, and Issue of Vehicles and Spare Engines

A-4. Other Publications

The following publications contain information pertinent to major item materiel and associated equipment:

a. Vehicle.

Lubrication—Truck, Cargo, 5-Ton, 8 x 8, M656; Truck, Tractor, 5-Ton, 8 x 8, XM757; Truck, Van, Expansible, 5-Ton, 8 x 8, XM791	LO 9-2320-230-12
Operation—Truck, Cargo, 5-Ton, 8 x 8, M656; Truck, Tractor, 5-Ton, 8 x 8, XM757; Truck, Van, Expansible, 5-Ton, 8 x 8, XM791	TM 9-2320-230-10
Organizational Parts—Truk, Cargo, 5-Ton, 8 x 8, M656; Truck, Tractor, 5-Ton, 8 x 8, XM757; Truck, Van, Expansible, 5-Ton, 8 x 8, XM791	TM 9-2320-230-20P
Equipment Serviceability Criteria— Truck, Cargo, 5-Ton, 8 x 8, M656; Truck, Tractor, 5-Ton, 8 x 8, XM757; Truck, Van, Expansible, 5-Ton, 8 x 8, XM791	TM 9-2320-230-ESC

b. Camouflage.

Camouflage, Basic Principles and Field Camouflage	FM 5-20
Camouflage of Vehicles	FM 5-20B

c. Decontamination.

Chemical, Biological, and Radiological (CBR) Decontamination	TM 3-220
Defense Against CBR Attack	FM 2140

d. General.

Accident Reporting and Records	AR 385-40
Basic Cold-Weather Manual	FM 31-70
Cooling Systems: Vehicles and Powered Ground Equipment	TM 9-2858
Manual for the Wheeled Vehicle Driver	TM 21-305
Driver Selection and Training (Wheeled Vehicles)	TM 21-300
Deep-Water Fording of Ordnance Materiel	TM 9-238
Fording Kits for Combat and Transport Vehicles	MIL-F-3201
Command Maintenance Management Inspections	AR 750-8
Motor Transportation, Operations	FM 25-10
Mountain Operations	FM 31-72
Northern Operations	FM 31-71

Operation and Maintenance of Army Materiel in Extreme Cold Weather (0°F. to −65°F.)	TM 9–207
Ordnance Direct Support Service	FM 9–3
Ordnance General and Depot Support Service	FM 9–4
Petroleum Handling Equipment and Operations	TM 10–1101
Preservation, Methods of	MIL–P–116
Principles of Automotive Vehicles	TM 9–8000
Prevention of Motor Vehicle Accidents	AR 385–55
Ordnance Maintenance Spark Plugs Used on Ordnance Materiel	TM 9–8638
Functional Government Grouping	TB 750–93–1

e. Maintenance and Repair.

Care and Maintenance of Pneumatic Tires	TM 9–1870–1
Cleaning of Ordnance Materiel	TM 9–208–1
Combat Vehicles and Tactical Transport Vehicles: Procedure for Starting Engines with Slave Cable	TB ORD 537
Description, Use, Bonding Techniques, and Properties of Adhesives	TB ORD 1032
General Supply:	
Winterization Kits for Army Tank-Automotive Materiel	SB 9–16
Inspection, Care and Maintenance of Antifriction Bearings	TM 9–214
Tank-Automotive Gasoline Engines: Lubrication Before Use	TB ORD 392
Lubrication of Ordnance Materiel	TM 9–273
Materials Used for Brazing, Welding, Soldering, Arc Cutting, and Metallizing	TM 9–237/1
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals	TM 9–247
Operation and Organizational, Field and Depot Maintenance: Storage Batteries, Lead-Acid Type	TM 9–6140–200–15
Ordnance Tracked and Wheeled Vehicle Hull and Chassis Wiring; Repair of Cracked or Peeled Plastic, Natural Rubber, or Synthetic Rubber-Covered Conduit Cables	TB ORD 650
Organization, Policies, and Responsibilities for Maintenance Operation	AR 750–5
Painting Instructions for Field Use	TM 9–213
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems	TB ORD 651
Welding Theory and Application	TM 9–237
Operator and Organizational Maintenance	TM 9–4910–401–12
Operator and Organizational Maintenance	TM 9–4910–402–12
Operator Organizational, Field and Depot Maintenance	TM 5–4520–209–15

f. Shipment and Limited Storage.

Color and Marking of Army Materiel	AR 746–5
Preservation, Packaging, and Packing of Military Supplies and Equipment	TM 38–230
Processing of Unboxed Self-Propelled and Towed Class II Ordnance General Supplies and Related Materiel for Shipment and Storage	TB 9–299/1
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other than Ammunition and Army Aircraft	TB ORD 385

Preservation, Packaging and Packing Materials, Supplies, and Equipment Used by the Army	SB 38-100
Army Equipment Record Procedures	TM 38-750
Shipment and Limited Storage	MIL-V-62038

APPENDIX B

MAINTENANCE ALLOCATION CHART

B-1. General

The maintenance allocation chart designates overall responsibility for the maintenance function of an end item or assembly. Allocation of maintenance operations is made on the basis of time, tools, and skills normally available to the various levels in a combat situation and influenced by maintenance policy and sound maintenance practices, as outlined in AR 750-5 and FM 9-10. Deviation from maintenance operations allocated in the maintenance allocation chart is authorized only upon approval of the Army commander.

B-2. Explanation of Columns on the MAC

a. Group Number. This group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1 Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Functional Group. This column contains a brief description of the components of each functional group.

c. Maintenance Function. This column lists the various maintenance operations (1, 2, 3, 4, 5, or %%) and indicates the lowest maintenance level authorized to perform these operations. The symbol designation for the various maintenance levels is as follows:

1	Operator or Crew
2 or %%	Organizational
3	Direct Support
4	General Support
5	Depot

The Maintenance Operations are defined as follows:

INSPECT	To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
TEST	To verify serviceability and to detect electrical or mechanical failure by use of test equipment.
SERVICE	To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.
ADJUST	To rectify to the extent necessary to bring into proper operating range.
ALIGN	To adjust specified variable elements of an item to bring to optimum performance.
CALIBRATE	To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
INSTALL	To set up for use in an operational environment such as an emplacement, site, or vehicle.

REPLACE	To replace unserviceable items with serviceable assemblies, subassemblies or parts.
REPAIR	To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.
OVERHAUL	To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.
REBUILD	To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.
SYMBOL "% %"	The symbol "%%" which applies to organizational maintenance indicates that the particular maintenance function may be performed provided it is specifically authorized by the direct support maintenance officer. Use of the symbol will apply only to replacement of major assemblies and time consuming operations which are within the capabilities of organization, but over which control by the commodity commands is considered essential. In no case will the direct support maintenance officer require the accomplishment of a "%%" maintenance function by an organization or unit, and in no case will a "%%" function authorize stockage of parts at organizational level.

d. Tools and Equipment. Letters "SPTO" in this column indicate special tools are required for performing the specific operation.

e. Remarks. This column lists references to the note page at the end of the MAC. Each note refers to a different publication pertinent to the operation being performed.

MAINTENANCE ALLOCATION CHART

(1)	(2)	(3) Maintenance function											(4)	(5)
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools & equipment	Remarks
01	**ENGINE**													
0100	**Engine Assembly:**													
	Engine	..	..	1	3	..	..	..	%%	3	4	..	SPTO	See Note 1
	Mounting, engine	..	..	..	..	..	..	..	2					
	Power Plant	..	..	..	..	..	..	..	2					
0101	**Crankcase, Block, Cylinder Head:**													
	Head, cylinder	..	..	..	..	..	..	..	3	4				
	Cylinder, sleeve and piston assy (pins & rings).	..	..	..	..	..	..	..	4					

MAINTENANCE ALLOCATION CHART—Continued

(1) Group No.	(2) Functional group	(3) Maintenance function Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	(4) Tools & equipment	(5) Remarks
0102	**Crankshaft:**													
	Bearing crankshaft								4					
	Crankshaft								4	4				
	Pulley drive								3					
0103	**Flywheel Assembly:**													
	Flywheel								3					
	Gear, ring flywheel								3					
0104	**Pistons, Connecting Rod:**													
	Bearing connecting rod								4					
	Rod, connecting								4	4				
0105	**Valves, Camshaft, Timing System:**													
	Arm, rocker								3					
	Bearing, camshaft								4					
	Camshaft								3					
	Gears, helical (gear train) timing								3					
	Guides, valve								4					
	Insert, valve (seat)								4					
	Rods, push								3					
	Screw, adjusting								3					
	Seals, oil, gear case cover								3					
	Shaft, rocker lever								3					
	Spring, valve								4					
	Tappet, valve								3					
	Valve, intake and exhaust				3				4	4				
0106	**Engine Lubrication System:**													
	Breather, crankcase			2					2					
	Hose and connections								2					
	Element, oil, filter								2					
	Filter, oil									3				
	Pan oil								3	3				
	Pump, oil, main and scavenge								3					
	Valves, pressure regulator & control								3	4				
	Oil cooler								3	3				
0108	**Intake and Exhaust Manifolds:**													
	Manifold, exhaust and intake								3					
03	**FUEL SYSTEM**													
0301	**Fuel Injector:**													
	Injector, fuel pump						4		3	4			SPTO	
	Nozzle, fuel injector			3					3					
	Control rod				2				2					
	Lines and fittings, high pressure fuel								3					
	Screen, injector inlet			3					3					
0302	**Fuel Pump:**													
	Pump, fuel (electrical) fuel tank								2					
0304	**Engine Air Cleaner:**													
	Cleaner, air			2						2				
	Element			2					2					
	Hose and clamps								2					
	Indicator, air cleaner								2					

MAINTENANCE ALLOCATION CHART—Continued

(1)	(2)	(3) Maintenance function											(4)	(5)
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools & equipment	Remarks
0305	Turbocharger:													
	Turbocharger			3					3	4			SPTO	See Note 2
0306	Fuel Tanks, Lines, fittings, and Shutoff Valve and Control:													
	Controls, fuel shut-off								2					
	Lines and fittings, low pressure fuel								2					
	Tank, fuel			1					2	3				
	Solenoid, fuel shut-off								2					
0309	Fuel Filter System:													
	Strainer, fuel (primary)			1					2					
	Filter, fuel (secondary)			1					2	3				
	Element								2					
	Filter, fuel (final)			1					2					
	Element								2					
0311	Engine Starting Aids:													
	Spark Plug								2					
	Harness								2					
	Lines and fittings								2					
	Nozzle, fuel								2					
	Pump fuel (manifold heater)								3					
	Unit, ignition (coil)								3					
	Filter, fuel								2					
0312	Accelerator and Throttle Control:													
	Controls and linkage, accelerator and throttle.			2	2				2	2				
04	EXHAUST SYSTEM													
0401	Pipes:													
	Pipes and elbows, exhaust								2					
	Shield, exhaust pipe								2					
05	COOLING SYSTEM													
0501	Radiator, Engine:			1					2	3				
0502	Shroud, Radiator Fan:									3				
0503	Water Manifold, Headers, Thermostat and Housing Gasket:													
	Hose, radiator								2					
	Lines and fittings								2					
	Thermostat								2					
0504	Water Pump:													
	Pump, water								2					
0505	Fan Assembly:													
	Belt, fan				2				2					
	Fan								2					
	Idler assembly, belt								2					
06	ELECTRICAL SYSTEM													
0601	Generator, Alternator:													
	Voltage				2									
	Alternator (30–80)								2	3				See Note 3
	Belt, drive, alternator				2				2					
	Relay, alternator								2					

MAINTENANCE ALLOCATION CHART—Continued

(1)	(2)	(3) Maintenance function											(4)	(5)
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools & equipment	Remarks
0603	**Starting Motor:**													
	Armature								3	3				
	Drive Starter								3					
	Seal								3					
	Starter and solenoid assembly								2	3				
	Switch, starter								2					
	Brushes								3					
	Solenoid								3					
0607	**Instrument or Engine Control Panel:**													
	Breakers, circuit								2					
	Switches								2					
	Instruments								2					
	Lamps								2					
	Lights, indicator								2					
	Switches								2					
	Control direction signal								2					
	Flasher								2					
0609	**Lights:**													
	Lamps and lamp units								2					
	Lights				2				2	2				
0610	**Sending Units and Warning Switches:**													
	Buzzer, warning								2					
	Switch, warning light								2					
	Unit, sending								2					
0611	**Horn:**													
	Horn				2				2					
	Switch, horn (button)								2					
	Horn wire								2	2				
	Contact, lower steering column								2					
0612	**Batteries, Storage:**													
	Battery			2					2					
	Cable, battery								2					
	Receptacle, slave								2	3				
	Support, battery									2				
0613	**Cab or Chassis Wiring Harness:**													
	Cable assy, (alternator-starter relay)								2					
	Cable assy, (ground, engine, frame)								2					
	Harness, chassis wiring								3	2				
	Harness, engine wiring								3	2				
	Harness, cab wiring								3	2				
	Receptacle, trailer coupling								2					
07	**TRANSMISSION**													
0708	**Torque Converter:**													
	Torque converter								4					
0710	**Transmission Assembly:**													
	Element, oil filter								2					
	Seal, output shaft								3					
	Transmission			1	3				%%	4	4		SPTO	See Note 4
	Linkage				2				2					

MAINTENANCE ALLOCATION CHART—Continued

(1) Group No.	(2) Functional group	(3) Maintenance function											(4) Tools & equipment	(5) Remarks
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
0714	Servo Unit:													
	Governor		3						4					
	Valve body control								4	4				
0721	Coolers, Pumps, Motors:													
	Cooler, radiator								2					
	Lines and fittings								2					
	Thermostat								2					
08	**TRANSFER ASSEMBLY**													
0801	Power Transfer Assembly:													
	Control shifting									3				
	Coupling, yoke input and output								3					
	Flange output								3					
	Cushion, mounting								2					
	Gear, speedometer								3					
	Pinion, speedometer drive								3					
	Seals, input and output shaft								3				SPTO	See Note 5
	Transfer			2					% %	4	4		SPTO	See Note 5
09	**PROPELLER SHAFTS**													
0900	Propeller Shafts:													
	Shaft, propeller			2					2					
	Joint, kit, universal								2					
10	**FRONT AXLE**													
1000	Front Axle Assembly:													
	Axle Assembly			2					3	3	4			
1002	Differential:													
	Differential Assembly								3	4	4			See Note 6
	Seal, output yoke								2					
	Yoke								2					
1004	Steering Wheel Mechanism and Leaning:													
	Boot, CV joint housing								2					
	Bushing, knuckle								2					
	Axle shafts and CV joint assembly								2	3				
	Knuckle, steering housing								2					
	Arm steering								2					
	Spindle, wheel								2					
11	**REAR AXLE**													
1100	Rear Axle Assembly:													
	Spindle, wheel			2					3	3	4			
	Shaft, axle								2					
1102	Differential								2					
	Differential assembly								3	4	4			See Note 6
	Seal, output yoke								2					
	Yoke								2					
12	**BRAKES**													
1201	Shoes, brake, hand				2				2					
	Drum, brake, hand								2					
	Linkage and lever				2				2					

MAINTENANCE ALLOCATION CHART—Continued

(1)	(2)	(3) Maintenance function											(4)	(5)
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools & equipment	Remarks
1202	Shoe, brake, service				2				2					
1208	Reservoir, air			2					2					
	Chamber, brake, air									3				
	Lines, valves and fittings (air brake system).													
	Lines and fittings (air low pressure areas system.													
	Valve, foot control								2	2				
	Valve, hand control								2	3				
1209	Compressor, air								2					
	Belt, drive								2					
	Pulley								2					
	Governor, air				2				2					
1211	Coupling, trailer, air brake control								2					
	Hose, trailer brake								2					
13	WHEELS, HUBS													
1311	Bearings, wheel hub			2	2				2				SPTO	
	Races, wheel hub bearing								2				SPTO	
	Drum, brake								2					
	Seals, brake drum								2					
	Hub, wheel								2				SPTO	
	Seals, inner and outer bearings								2				SPTO	
	Stud, hub and wheel								2					
	Wheel								2					
1313	Tires								2	2	4			See Note 7
	Wheel and tire			1					1					
14	STEERING													
1401	Link, drag front								2				SPTO	
	Link, drag rear				2				2					
1401	End, tie rod				2				2					
	Reach Rod front								2					
	Reach Rod rear				2				2					
	Rod, tie				2				2					
	Idler Arm Support								3					
	Idler Arm			2					2	3				
	Seals, idler arm								2					
	Arm, steering pitman								3					
	Column, steering								3	3				
	Boot, steering column								3					
	Wheel, steering								2					
1407	Gear, steering assembly			2	2				3	4			SPTO	See Note 8
1410	Pump, hydraulic (steering)								3					
1411	Lines and Fittings, power steering								2					
1412	Power Cylinder and Control valve assy.				2				2	3				See Note 8
	Seal Kits, control valve and cylinder shaft.								3					

MAINTENANCE ALLOCATION CHART—Continued

(1) Group No.	(2) Functional group	(3) Maintenance function Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	(4) Tools & equipment	(5) Remarks
1413	Reservoir, power steering			1					2	3				
15	FRAME, TOWING ATTACHMENTS AND DRAW BARS													
1501	Bumperette, rear								2	3				
	Bumper, front									3				
	Ramp, fifth wheel								2	3				
1501	Platform									3				
	Shock absorber, brackets								3					
1503	Pintle, towing								2	2				
	Shackle, lifting								2					
1506	Fifth wheel								2	3				
16	SPRINGS AND SHOCK ABSORBERS													
1601	Bushing, spring seat (Bogie)								3					
	Springs, front and rear								2				SPTO	See Note 9
	Spring wear pads								2					
	Spring bumpers								2					
	Shaft, bogie								4					
1604	Shock Absorbers								2					
	Shock Absorber, bushings								2					
1605	Torque rods								2					
18	BODY AND CAB													
1801	Cab									3				
	Guard, radiator									2				
	Door									3				
	Door glass								2					
	Regulator, door glass				2				2					
	Handles, door and regulator								2					
	Latch, door								2					
1801	Air lines and fittings								2					
	Valve, low pressure regulating								2					
	Windshield, glass								2					
	Seal, air, door								2					
	Windshield assy							1						
	Insulator, cab mounting, front and rear.								2					
1806	Cushion, seat and back								2	3				
	Seat assembly									3				
1808	Stowage box, brackets, straps, spare tire straps.								2	3				
	Pioneer bracket									3				
	Bracket, container liquid									3				
1810	Body									3				
	Gate, tail									3				
	Platform and brackets									3				
	Seat, troop									3				
	Spring, locking (troop seat)								2					
	Seal, side gate and tail gate								2					
	Lock, tail gate									3				

MAINTENANCE ALLOCATION CHART—Continued

(1)	(2)	(3) Maintenance function											(4)	(5)
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools & equipment	Remarks
1812	Special Purpose Bodies:													
	Beam, retractable	--	--	--	--	--	--	--	4					
	Cable, counter-balance side panel	--	--	--	--	--	--	--	2					
	Clamp, locking, ladder	--	--	--	--	--	--	--	2					
1812	Clamp, toggle, side panel to roof	--	--	--	--	--	--	--	2					
	Control, hand, air conditioner door	--	--	--	--	--	--	--	--	2				
	Filter, fuel, heater	--	--	--	--	--	--	--	2					
	Glass, window	--	--	--	--	--	--	--	2					
	Hinge, door	--	--	--	--	--	--	--	2					
	Line and fittings, fuel tank to heater	--	--	--	--	--	--	--	2	2				
	Lock and latch, door	--	--	--	--	--	--	--	2					
	Lock, drive shaft rachet	--	--	--	--	--	--	--	2					
	Lock, side panel	--	--	--	--	--	--	--	2					
	Panel, blackout, window	--	--	--	--	--	--	--	2					
	Plate, striker, door	--	--	--	--	--	--	--	2					
1812	Pump, fuel heater	--	--	--	--	--	--	--	2					
	Ratchet, drive shaft	--	--	--	--	--	--	--	2					
	Regulator, window	--	--	--	--	--	--	--	2					
	Roller, retractable beam	--	--	--	--	--	--	--	4					
	Screen, window	--	--	--	--	--	--	--	2					
	Seal, window glass	--	--	--	--	--	--	--	2					
	Shaft, drive, side panel expanding and retracting mechanism.	--	--	--	--	--	--	--	4					
	Spring, door check	--	--	--	--	--	--	--	2					
	Valve, shutoff, heater fuel	--	--	--	--	--	--	--	2					
	Weatherstrip, doors and panels	--	--	--	--	--	--	--	2					
	Wheel, drive, retractable beam	--	--	--	--	--	--	--	4					
1812	Lights, clearance	--	--	--	--	--	--	--	2	2				
	Power supply, fuel pump	--	--	--	--	--	--	--	--	2				
	Wiring, electrical (24V)	--	--	--	--	--	--	--	3	2				
	Box, electrical (110V)	--	--	--	--	--	--	--	3					
	Cable, power (110-208V)	--	--	--	--	--	--	--	2					
	Fixture, fluorescent light	--	--	--	--	--	--	--	2					
	Jack, phone	--	--	--	--	--	--	--	2					
	Lamp (110V)	--	--	--	--	--	--	--	2					
	Lens, dome light	--	--	--	--	--	--	--	2					
	Light, dome (110V)	--	--	--	--	--	--	--	2					
	Light, fluorescent	--	--	--	--	--	--	--	2					
1812	Receptacle, power cable	--	--	--	--	--	--	--	3					
	Reel, power cable	--	--	--	--	--	--	--	--	3				
	Starter, fluorescent light	--	--	--	--	--	--	--	2					
	Switch, control panel electrical box (resistor type).	--	-	--	--	--	--	--	3					
	Switch, light (110V)	--	--	--	--	--	--	--	2					
	Wiring, electrical (110-208V)	--	--	--	--	--	--	--	3	3				
20	WINCH AND POWER TAKEOFF													See Note 10
2001	Winch	--	--	2	--	--	--	--	2	3	4	--		
	Band, automatic brake	--	--	--	2	--	--	--	2	3				
	Cable	--	--	--	--	--	--	--	2					

MAINTENANCE ALLOCATION CHART—Continued

(1) Group No.	(2) Functional group	(3) Maintenance function Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	(4) Tools & equipment	(5) Remarks
2002	Power takeoff								3	4				See Note 11
	Reverse gear box			2					3	3	4			
2002	Controls and linkage				2				2					
	Pin, shear								2					
	Prop shaft						2		2					
	U joint								2					
	Pillow blocks (brg's)								2					
22	BODY, CHASSIS OR HULL AND ACCESSORY ITEMS													
2201	Bows, cargo and cab							1	2					
	Cover, cargo box							1	2	3				
	Cover, cab							1	2	3				
2202	Motor, windshield wiper								2					
	Control windshield wiper								2					
2202	Lines and fittings, windshield wiper motor.								2					
	Arm and blade, windshield wiper								2					
	Mirrors, side and reflectors				1				2					
2205	Bilge, pump and drains, and connections.								2	3				
	Brushes, bilge pump								2					
	Strainer, bilge pump			1					2					
2210	Plates, vehicle data and instructions								2					
33	SPECIAL PURPOSE KITS													
3303	Winterization kits													
	Arctic (−65°F)			2				3	3	2				
	Coldweather (−25°F)			2				3	3	2				
3307	Special Kits													
	Windshield defogging							3	3	2				
	Cargo Bow Height							3	3	2				
	Air Brake-Hand Control							3	3	2				
	Machine Gun Mount							3	3	2				
	Slave cable							3	3	2				
	Slave cable (pershing)							3	3	2				
	Vehicle slinging							3	3	2				
	Hard top-machine gun adapter							3	3	2				
	100-amp alternator							3	3	2				
	Soft top-machine gun adapter							3	3	2				
	Tail gate support							3	3	2				
47	INSTRUMENTS, SPEED AND DISTANCE													
4701	Speedometer drive shaft assembly								2	2				
	Speedometer								2					
	Adapter, speedometer								2					
	Adapter, tachometer								2					
	Tachometer drive shaft assembly								2	2				
	Tachometer								2					
4702	Gage, air pressure								2					
	Lines and fittings								2					

NOTES

Note 1—See TM 9-2815-210-35P for special tools for the LDS 465-2 Engine. Adjusting, replacement and repair, see TM 9-2815-210-35.

Note 2—See TM 9-2990-201-45 for special tools and repair of turbocharger.

Note 3—See TM 9-2920-225-35 for repair of alternator.

Note 4—See TM 9-2520-236-35P for special tools for the TX 200-6 transmission.

Note 5—See TM 9-2320-230-35P for special tools for the transfer. Adjusting, replacement and repair, see TM 9-2320-230-34.

Note 6—Replacement and repair of differential assembly see TM 9-2320-230-34.

Note 7—Overhaul function requires turn in of tires for recap.

Note 8—See TM 9-2320-230-34P for special tools for steering gear. Replacement and repair see TM 9-2320-230-34.

Note 9—See TM 9-2320-230-20P for special tools for spring replacement.

Note 10—Repair of winch, see TM 9-2320-230-34.

Note 11—Repair power take-off, see TM 9-2320-230-34.

INDEX

	Paragraph	Page
Accelerator and throttle control rods:		
Description	2–57*a*	2–180
Inspection and repair	2–57*f*	2–182
Service	2–57*b*	2–180
Accelerator control rod replacement	2–57*c*	2–180
Adapter, compressor airhose	2–63*e*	2–188
Adapter, speedometer shaft:		
Assembly	2–280*b*	2–347
Disassembly	2–278*b*	2–346
Installation	2–281*a*	2–348
Removal	2–277*c*	2–346
Repair	2–279	2–346
Adapter, tachometer drive shaft:		
Assembly	2–280*b*	2–347
Disassembly	2–278*b*	2–346
Installation	2–281*b*	2–348
Removal	2–277*d*	2–346
Repair	2–279	2–346
Air cleaner, engine:		
Installation	2–61*c*	2–185
Removal	2–61*a*	2–184
Repair	2–61*b*	2–185
Service	2–60	2–183
Air compressor:		
Installation	2–179*b*	2–290
Removal	2–179*a*	2–289
Air ducts and hoses	2–63	2–185
Air governor:		
Adjustment	2–180*c*	2–291
Installation	2–180*b*	2–290
Removal	2–180*a*	2–290
Air induction system	2–59	2–183
Air lines and fittings, body and cab:		
Installation	2–219*b*	2–316
Removal	2–219*a*	2–316
Air lines, hoses and fittings, brakes:		
Inspection	2–165*b*	2–271
Installation	2–165*c*	2–272
Removal	2–165*a*	2–271
Air manifold, axle:		
Installation	2–177*b*	2–286
Removal	2–177*a*	2–286
Air pressure system:		
Description	2–164	2–271
Pressurization system	2–164*d*	2–271
Service brake system	2–164*a*	2–271
Transfer control system	2–164*c*	2–271
Windshield wiper system	2–164*b*	2–271
Air reservoir:		
Assembly and installation	2–169*d*	2–281
Disassembly	2–169*c*	2–281
Removal	2–169*b*	2–280
Service	2–169*a*	2–280
Air trap:		
Installation	2–173*b*	2–284
Removal	2–173*a*	2–284
Airbrake hand control kit (M656 and XM791):		
General	3–41	3–32
Parts list	3–47	3–34
Preventive-maintenance services	3–44	3–32
Replacement of components	3–46	3–33
Brake valve	3–46*a*	3–33
Floor coupling	3–46*b*	3–33
Hose assembly	3–46*d*	3–33
Stoplight switch	3–46*c*	3–33
Service upon receipt of materiel	3–43	3–32
Tabulated data	3–42	3–32
Troubleshooting	3–45	3–33
Alternator assembly:		
Description	2–85	2–204
Installation	2–86*b*	2–206
Removal	2–86*a*	2–205
Voltage adjustment	2–88	2–208
Alternator drive belts:		
Adjustment	2–86*b*	2–206
Replacement	2–81*b*	2–203
100-ampere alternator kit:		
General	3–34	3–28
Maintenance instructions for replacement of components	3–39	3–31
Alternator, pulley and belts	3–39*c*	3–31
Cable assembly	3–39*a*	3–31
Regulator	3–39*b*	3–31
Parts list	3–40	3–32
Preventive-maintenance services	3–37	3–28
Service upon receipt of materiel	3–36	3–28
Tabulated data	3–35	3–28
Troubleshooting	3–38	3–29

	Paragraph	Page
Arctic kit (−65° F.):		
Description	3-11	3-13
Maintenance instructions for replacement of components	3-16	3-15
Coolant heater	3-16*k*	3-18
Coolant heater control panel (M656 and XM791)	3-16*c*	3-15
Coolant heater control panel (XM757)	3-16*d*	3-16
Coolant heater exhaust pipes	3-16*h*	3-17
Coolant heater front cable assembly (M656 and XM791)	3-16*e*	3-16
Coolant heater front cable assembly (XM757)	3-16*f*	3-16
Coolant heater HI-LO switch	3-16*m*	3-20
Coolant heater hoses	3-16*i*	3-17
Coolant heater indicator lamp	3-16*n*	3-20
Coolant heater pump	3-16*j*	3-18
Tire inner tube	3-16*b*	3-15
Coolant heater rear cable assembly	3-16*g*	3-16
Coolant heater RUN-OFF-START switch	3-16*l*	3-19
Parts list	3-17	3-20
Preventive-maintenance services	3-14	3-14
Service upon receipt of materiel	3-13	3-13
Tabulated data	3-12	3-13
Troubleshooting	3-15	3-14
Axle shaft, rear:		
Description	2-152*a*	2-263
Inner oil seal replacement	2-148*d*	2-258
Installation	2-152*c*	2-263
Outer oil seal replacement	2-148*d*	2-258
Removal	2-152*b*	2-263
Axle shafts and C-V joint assembly:		
Description	2-145*a*	2-250
Installation	2-145*c*	2-251
Removal	2-145*b*	2-250
Batteries:		
Installation	2-121*d*	2-230
Removal	2-121*b*	2-230
Service	2-121*a*	2-229
Battery cable replacement	2-122	2-230
Battery holddown frame	2-121*c*	2-230
Battery-generator indicator	2-94*e*	2-213
Bellow, bonnet control rod:		
Installation	2-233*b*	2-323
Removal	2-233*a*	2-323
Belt, fan idler:		
Installation	2-79*b*	2-202
Removal	2-79*a*	2-202
Bilge pump:		
Installation	2-273*c*	2-343
Removal	2-273*a*	2-342
Repair	2-273*c*	2-343
Blackout driving lights:		
Adjustment	2-118	2-228
Installation	2-116*b*	2-228
Removal	2-116*a*	2-228
Repair	2-117	2-228
Blocking for shipment	4-3	4-4
Brake band, winch:		
Adjustment	2-258*a*	2-334
Installation	2-258*c*	2-334
Removal	2-258*b*	2-334
Brakedrum, handbrake:		
Installation	2-158*b*	2-267
Removal	2-158*a*	2-266
Brakedrum, rear axle:		
Installation	2-152*c*	2-263
Removal	2-152*b*	2-263
Brakes	2-155	2-265
Brakeshoe, handbrake:		
Adjustment	2-160	2-268
Installation	2-159*b*	2-267
Removal	2-159*a*	2-267
Brakeshoe, service:		
Adjustment	2-157	2-266
Installation	2-156*b*	2-265
Removal	2-156*a*	2-265
Breather, engine crankcase:		
Installation	2-45*b*	2-169
Removal	2-45*a*	2-169
Brush guard, radiator:		
Installation	2-210*b*	2-312
Removal	2-210*a*	2-311
Bump stop:		
Installation	2-206*b*	2-310
Removal	2-206*a*	2-310
Bumperette, rear:		
Installation	2-198*b*	2-307
Removal	2-198*a*	2-306
Bushing, steering knuckle:		
Description	2-146*a*	2-251
Installation	2-146*c*	2-252
Removal	2-146*b*	2-251
Cable, throttle control	2-95*h*	2-215
Cable, winch:		
Installation	2-259*b*	2-335
Removal	2-259*a*	2-335
Service	2-257*a*	2-332
Cables, wiring	2-123*b*	2-231

	Paragraph	Page
Cargo bow height extension kit (M656):		
General	3-67	3-41
Parts list	3-70	3-43
Preventive-maintenance services	3-68	3-41
Replacement of components	3-69	3-41
Personnel heater exhaust extension	3-69b	3-42
Tarpaulin tiedown ropes	3-69c	3-43
Vehicle exhaust extension	3-69a	3-41
Circuit breaker:		
Installation	2-100b	2-222
Removal	2-100a	2-222
Clamp, van ladder locking:		
Installation	2-231b	2-323
Removal	2-231a	2-322
Clamp (toggle), van side panel-to-roof:		
Installation	2-232b	2-323
Removal	2-232a	2-322
Cold weather kit (-25° F.):		
Description	3-4	3-1
Maintenance instructions for replacement of components	3-9	3-6
Alcohol vaporizer lines and fittings	3-9j	3-10
Brush guard cover	3-9k	3-11
Cable harness	3-9h	3-10
Defroster hoses	3-9f	3-8
Fuel filter	3-9c	3-6
Fuel pump	3-9b	3-6
Heater assembly and diverter assembly	3-9a	3-6
Heater control panel	3-9d	3-6
Heater exhaust system	3-9e	3-7
Heater hoses	3-9g	3-8
Heater fuel lines	3-9i	3-10
Slave kit	3-9l	3-12
Preventive-maintenance	3-7	3-2
Service upon receipt of materiel	3-6	3-2
Tabulated data	3-5	3-2
Troubleshooting	3-8	3-2
Connectors, electrical	2-123d	2-234
Cooling system, engine:		
Description	2-74	2-193
Service, cleaning and testing	2-75	2-195
Counterbalance cables, van hinged roof and floor:		
Installation	2-230b	2-321
Removal	2-230a	2-321
Couplings, air:		
Installation	2-182b	2-291
Removal	2-182a	2-291
Cover and bows, cargo box:		
Installation	2-267b	2-338
Removal	2-267a	2-338
Cushions, seat and back:		
Installation	2-223b	2-319
Removal	2-223a	2-318
Cutoff valve, fuel solenoid:		
Description	2-54a	2-179
Installation	2-54c	2-179
Removal	2-54b	2-179
C-V joint assembly:		
Description	2-145a	2-250
Installation	2-145c	2-251
Removal	2-145b	2-250
Data plates:		
Installation	2-274b	2-344
Removal	2-274a	2-344
Destruction of materiel to prevent enemy use	4-5	4-8
Differential input and output yokes:		
Description	2-151	2-262
Installation	2-142c	2-246
Removal	2-142a	2-245
Differential thru shaft front seal:		
Replacement	2-143b	2-248
Service	2-143c	2-249
Differential thru shaft rear seal	2-143b	2-248
Differential thru shaft replacement	2-143a	2-247
Directional signal control:		
Installation	2-102b	2-223
Removal	2-102a	2-223
Dome light replacement (van)	2-252	2-330
Domestic shipping instructions	4-1	4-1
Door air seal, cab:		
Installation	2-220b	2-317
Removal	2-220a	2-317
Door assembly, cab:		
Installation	2-217b	2-315
Removal	2-217a	2-314
Door check, van	2-242d	2-326
Door glass, cab:		
Installation	2-214b	2-313
Removal	2-214a	2-313
Door glass and frame, cab:		
Installation	2-213b	2-313
Removal	2-213a	2-312
Door handle replacement, cab	2-211a	2-312
Door handles, van:		
Installation	2-241b	2-325
Removal	2-241a	2-325

	Paragraph	Page
Door hinge, van:		
Installation	2-241*b*	2-325
Removal	2-241*a*	2-325
Door hinge adjustment, cab	2-218	2-315
Door inner panel replacement, cab	2-212*b*	2-312
Door latch replacement, cab	2-212*a*	2-312
Door weatherstrip, van:		
Installation	2-243*b*	2-326
Removal	2-243*a*	2-326
Door window up-stop adjustment, cab	2-216	2-314
Drain cock, air reservoir:		
Installation	2-168*b*	2-278
Removal	2-168*a*	2-278
Drive belt and pulley, air compressor:		
Installation	2-178*b*	2-289
Removal	2-178*a*	2-287
Drive shaft ratchet, van:		
Installation	2-244*b*	2-326
Removal	2-244*a*	2-326
Drive shaft ratchet lock, van:		
Installation	2-245*d*	2-327
LockingPawls	2-245*a*	2-327
Locking plungers	2-245*b*	2-327
Removal	2-245*c*	2-327
Drive shafts, speedometer:		
Assembly	2-280*a*	2-347
Disassembly	2-278*a*	2-346
Installation	2-281*b*	2-348
Removal	2-277*a*	2-344
Repair	2-279	2-346
Drive shafts, tachometer:		
Assembly	2-280*a*	2-347
Disassembly	2-278*a*	2-346
Installation	2-281	2-348
Removal	2-277*b*	2-345
Repair	2-279	2-346
Electrical:		
Alternator	2-85	2-204
Batteries	2-121	2-229
Battery cables	2-122	2-230
Battery-generator indicator	2-94	2-211
Circuit breakers	2-100	2-222
Connectors	2-123*d*	2-234
Directional signal control	2-102	2-223
Dome light, van	2-252	2-330
Fuel level gage	2-94	2-211
Horn	2-105	2-224
Indicator lamp directional signal	2-104	2-223
Indicators:		
Air pressure warning	2-96	2-218
Battery-generator	2-94	2-211
Bilge pump	2-94	2-211
Headlight, high beam	2-94	2-211
Transmission coolant temperature	2-99	2-221
Transmission oil temperature	2-96	2-218
Lamp, dome light	2-251	2-329
Lights:		
Blackout driving	2-116	2-228
Clearance	2-249	2-328
Composite, front	2-114	2-227
Composite, tail	2-119	2-228
Fluorescent, van	2-250	2-329
Instrument cluster	2-94	2-211
Service headlight	2-110	2-225
Plugs, electrical	2-123	2-231
Power cable, van	2-255	2-331
Radio interference suppression	2-30	2-150
Selector switch, headlight beam	2-113	2-227
Spark plug, manifold heater	2-68	2-190
Starter assembly	2-85	2-204
Switch:		
Bilge pump	2-95*d*	2-214
Flame, manifold heater	2-95*l*	2-217
Fuel cutoff	2-95*j*	2-216
Fuel selector	2-95*e*	2-214
Light, 110-volts, van	2-253	2-330
Lights, vehicle	2-95*c*	2-213
Low pressure warning	2-98*b*	2-220
Master, vehicle	2-95*i*	2-215
Neutral start	2-98*a*	2-219
Pressure control valve:		
(M656 vehicle)	2-95*a*	2-213
(XM757 and XM791 vehicles)	2-95*b*	2-213
Protection control valve, truck tractor	2-95*f*	2-215
Stoplight	2-98*c*	2-226
Transmitters	2-99	2-221
Engine coolant temperature	2-99*c*	2-221
Engine oil pressure	2-99*a*	2-221
Fuel level	2-99*b*	2-221
Transmission oil temperature	2-99*d*	2-222
Troubleshooting:		
Electrical systems	2-20	2-24
System circuits	2-21	2-26
Test equipment	2-22	2-28
Low voltage tests	2-24	2-33
Wiring diagrams	2-27	2-129
Wiring harnesses and cables	2-123	2-231
Wiring harness, engine manifold heater	2-64	2-188
Wiring, 120-208 volt (van electrical)	2-248	2-328
Equipment, inspection and servicing	2-1	2-1

	Paragraph	Page
Exhaust pipes:		
Extension	2-73	2-193
Installation	2-73*b*	2-194
Removal	2-73*a*	2-193
Front	2-70	2-190
Installation	2-70*b*	2-190
Removal	2-70*a*	2-190
Front intermediate	2-71	2-191
Removal	2-71*a*	2-191
Intermediate	2-72	2-191
Installation	2-72*b*	2-193
Removal	2-72*a*	2-191
Exhaust system, engine:	2-69	2-190
Fan, engine:		
Installation	2-80*b*	2-202
Removal	2-80*a*	2-202
Fan drive belt, engine:		
Adjustment	2-81*d*	2-203
Replacement	2-81*a*	2-202
Fifth wheel (XM757):		
Installation	2-201*b*	2-308
Removal	2-201*a*	2-308
Filter, engine oil:		
Cleaning	2-46*c*	2-170
Installation	2-46*d*	2-171
Removal	2-46*b*	2-170
Service	2-46*a*	2-170
Filter, final fuel:		
Description	2-53*a*	2-179
Element replacement	2-53*b*	2-179
Filter replacement	2-53*c*	2-179
Filters, fuel:		
Bleed	2-52*c*	2-177
Drain	2-52*c*	2-177
Filter, fuel, manifold heater:		
Installation	2-66*b*	2-189
Removal	2-66*a*	2-189
Filter, fuel, secondary:		
Description	2-52*a*	2-177
Element replacement	2-52*c*	2-177
Filter replacement	2-52*d*	2-178
Fuel pressure test	2-52*b*	2-177
Filter, fuel, van heater:		
Replacement	2-234	2-323
Service	2-234	2-323
Filter, transmission oil:		
Installation	2-127*b*	2-236
Removal	2-127*a*	2-235
Fittings, air line	2-219	2-316
Flasher unit, directional signal control:		
Installation	2-103*b*	2-223
Removal	2-103*a*	2-223
Forms	1-2,A-2	1-2, A-2
Front axle:		
Description	2-141	2-245
Differential input and output yokes	2-142	2-245
Differential thru shaft	2-143	2-246
Shafts and C-V joint assemblies	2-145	2-250
Steering arm	2-144	2-249
Steering knuckle bushings	2-146	2-251
Steering knuckle housing and boot	2-147	2-253
Wheel hub and spindle	2-148	2-255
Front crossmember, cab:		
Installation	2-76*c*	2-199
Removal	2-76*b*	2-197
Fuel lines and fittings:		
Description	2-56*a*	2-179
Installation	2-56*c*	2-179
Removal	2-56*b*	2-179
Fuel lines and fittings, fuel tank to van heater	2-236	2-323
Fuel pump, fuel tank:		
Description	2-50*a*	2-174
Installation	2-50*c*	2-176
Removal	2-50*b*	2-175
Fuel pump, van heater:		
Description	2-55*a*	2-179
Installation	2-55*c*	2-179
Removal	2-55*b*	2-179
Fuel tank:		
Description	2-48*a*	2-172
Installation	2-48*c*	2-174
Removal	2-48*b*	2-172
Fuse, fuel tank pump:		
Description	2-49*a*	2-174
Installation	2-49*c*	2-174
Removal	2-49*b*	2-174
Gage:		
Air pressure	2-94*h*	2-213
Gage, engine coolant temperature	2-94*f*	2-213
Gage, engine oil pressure	2-94*d*	2-212
Gage, fuel level	2-94*g*	2-213
Gasket, hatch cover:		
Installation	2-228*b*	2-319
Removal	2-228*a*	2-319
Glass, van retractable sash:		
Installation	2-238*b*	2-324
Removal	2-238*a*	2-324
Glass, windshield:		
Installation	2-221*b*	2-317
Removal	2-221*a*	2-317

	Paragraph	Page
Glass, van stationary sash:		
Installation	2-237*b*	2-324
Removal	2-237*a*	2-324
Handle, cab window regulator	2-211*b*	2-312
Hardtop-to-machinegun mount adapter kit:		
General	3-55	3-37
Parts list	3-60	3-38
Preventive-maintenance services	3-58	3-38
Replacement of components	3-59	3-38
Service upon receipt of materiel	3-57	3-38
Tabulated data	3-56	3-38
Harness, wiring	2-123*b*	2-231
Hatch cover, engine	2-36	2-152
Headlights, service:		
Adjustment	2-112	2-226
Installation	2-110*b*	2-226
Removal	2-110*a*	2-225
Repair	2-111	2-226
Heater, engine manifold	2-67	2-189
Holddown frame, battery	2-121*c*	2-230
Horn:		
Button	2-105	2-224
Cable	2-107	2-225
Cover and contact assembly	2-106	2-224
Horn assembly	2-108	2-225
Hose, turbocharger elbow assembly	2-63*f*	2-188
Hoses, air cleaner	2-63	2-185
Hoses, air compressor	2-63	2-185
Hoses, coolant:		
Installation	2-78	2-201
Oil cooler inlet	2-77*e*	2-201
Oil cooler water inlet	2-77*g*	2-201
Radiator inlet	2-77*f*	2-201
Thermostat-to-water pump	2-77*c*	2-200
Water pump inlet	2-77*b*	2-200
Water pump outlet	2-77*d*	2-201
Hoses and fittings, hose tenna assembly:		
Installation	2-181*b*	2-291
Removal	2-181*a*	2-291
Hoses and fittings, power steering:		
Installation	2-195*b*	2-302
Removal	2-195*a*	2-302
Idler arm:		
Replacement	2-189*a*	2-295
Seal replacement	2-189*b*	2-295
Indicator:		
Air cleaner	2-62	2-185
Installation	2-62*b*	2-185
Removal	2-62*a*	2-185
Battery-generator	2-94*e*	2-218
Bilge pump	2-94*j*	2-213
Headlight high beam	2-94*j*	2-213
Low air pressure warning	2-96*d*	2-219
Transmission coolant temperature	2-99*c*	2-221
Transmission oil temperature	2-96*b*	2-221
Indicator shutoff, low air pressure warning	2-95*h*	2-215
Instruction plates	2-274	2-344
Instrument cluster:		
Description	2-93*a*	2-208
Installation	2-93*c*	2-211
Removal	2-93*b*	2-211
Instrument panel indicators	2-96	2-218
Instrument panel switches and controls	2-95	2-213
Insulators, cab mounting:		
Front	2-222*a,b,c*	2-317
Rear	2-222*c,d*	2-318
Lamp, dome light, van	2-251*b*	2-330
Lamp, indicator, directional signal control:		
Installation	2-104*b*	2-223
Removal	2-104*a*	2-223
Lens, dome light, van	2-251*a*	2-329
Lever and cable, handbrake:		
Adjustment	2-162	2-270
Installation	2-161*b*	2-270
Removal	2-161*a*	2-269
Lifting eye:		
Front	2-202*a*	2-308
Rear	2-202*b*	2-308
Lights:		
Blackout driving:		
Adjustment	2-118	2-228
Installation	2-116*b*	2-228
Removal	2-116*a*	2-228
Repair	2-117	2-228
Clearance:		
Installation	2-249*b*	2-328
Removal	2-249*a*	2-328
Composite front:		
Installation	2-114*b*	2-227
Removal	2-114*a*	2-227
Repair	2-115	2-227
Composite tail:		
Installation	2-119*b*	2-229
Removal	2-119*a*	2-229
Repair	2-120	2-229
Fluorescent, van:		
Fixture	2-250*a,b*	2-329
Light tube	2-250*c*	2-329
Starter	2-250*d*	2-329
Instrument cluster	2-94*i*	2-213
Limited storage	4-4	4-7

Paragraph Page
Lines, transmission oil:
  Installation 2–129*b* 2–237
  Removal 2–129*a* 2–237
Lines and fittings:
  Transmission oil cooler:
    Installation 2–130*b* 2–238
    Removal 2–130*a* 2–237
  Windshield wiper motor 2–270*b* 2–339
Loading for shipment 4–2 4–3
Locking spring, troop seat:
  Installation 2–225*b* 2–319
  Removal 2–225*a* 2–319
Locks side panel, van:
  Installation 2–246*b* 2–327
  Removal 2–246*a* 2–327
Lubrication:
  General instructions 2–9 2–5
  Special instructions 2–10 2–5
Lubrication system, engine 2–44 2–168
Machinegun mount kit (M656 and XM757):
  General 3–48 3–34
  Parts list 3–54 3–37
  Preventive-maintenance services 3–51 3–35
  Replacement of components:
    Handle 3–53*b* 3–37
    Strap 3–53*a* 3–37
  Service upon receipt of materiel 3–50 3–34
  Tabulated data 3–49 3–34
  Troubleshooting 3–52 3–36
Maintenance allocation chart:
  Explanation of columns on the MAC B–2 B–1
  General B–1 B–1
Manifold, steering knuckle air supply:
  Installation 2–176*b* 2–286
  Removal 2–176*a* 2–286
Mirror, cab rear vision 2–271*a* 2–339
Mounting cushions, transfer case:
  Installation 2–137*b* 2–241
  Removal 2–137*a* 2–241
Mounts:
  Engine front:
    Description 2–43*a* 2–167
    Installation 2–43*c* 2–168
    Removal 2–43*b* 2–167
  Engine rear:
    Description 2–42*a* 2–166
    Installation 2–42*c* 2–167
    Removal 2–42*b* 2–166

Paragraph Page
Nozzle, manifold heater:
  Installation 2–67*b* 2–190
  Removal 2–67*a* 2–189
Oil cooler, transmission:
  Installation 2–76*c* 2–199
  Removal 2–76*b* 2–197
Oil seals:
  Front axle:
    Installation 2–148*c* 2–258
    Removal 2–148*b* 2–255
  Rear axle 2–148*d* 2–258
Panel, window blackout, van:
  Installation 2–239*b* 2–324
  Removal 2–239*a* 2–324
Phone jack, van:
  Installation 2–254*b* 2–331
  Removal 2–254*a* 2–331
Pillow blocks, winch propeller shafts:
  Installation 2–264*b* 2–338
  Removal 2–264*a* 2–338
Plug, electrical 2–123*d* 2–234
Power cable, electrical, van:
  Installation 2–255*b* 2–332
  Removal 2–255*a* 2–331
Power cylinder and control valve, steering:
  Installation 2–193*b* 2–301
  Removal 2–193*a* 2–300
Power plant:
  Description 2–35 2–151
  Installation 2–40 2–162
  Mounting 2–36 2–152
  Removal 2–37 2–152
Power supply, van heater 2–247 2–327
Power takeoff and reverse gearbox, winch:
  Adjustment 2–261*a* 2–335
  Installation 2–261*c* 2–336
  Removal 2–261*b* 2–335
Preventive-maintenance:
  General instructions 2–11 2–5
  General procedures 2–16 2–6
  Intervals 2–14 2–6
  Purpose 2–13 2–6
  Responsibility 2–12 2–6
  Specific procedures 2–15 2–6
Propeller shafts:
  Vehicle:
    Description 2–138 2–242
    Installation 2–139*c* 2–243
    Service 2–139*a* 2–243

	Paragraph	Page
Winch:		
Installation	2–62*b*	2–185
Removal	2–62*a*	2–185
Publication indexes and general references	A–1	A–1
Radiator, engine:		
Description	2–76*a*	2–197
Installation	2–76*c*	2–199
Removal	2–76*b*	2–197
Radio interference suppression:		
Components	2–31	2–150
Description	2–32	2–151
Ground cables	2–33	2–151
Purpose	2–30	2–150
Test	2–34	2–151
Ramp, fifth wheel platform:		
Installation	2–200*b*	2–308
Removal	2–200*a*	2–307
Rear axle:		
Description	2–149	2–262
Differential thru shaft input and Output yokes and seals	2–151	2–262
Service	2–150	2–262
Shafts	2–152	2–263
Wheel spindle	2–153	2–264
Records	1–2	1–1
Reflectors (XM791)	2–271*b*	2–339
Regulator, cab window:		
Installation	2–215*b*	2–313
Removal	2–215*a*	2–313
Relay:		
Alternator (M656):		
Installation	2–89*b*	2–208
Removal	2–89*a*	2–208
Engine starter:		
Installation	2–91*b*	2–208
Removal	2–91*a*	2–208
Repair parts	2–8	2–5
Repairs, field expedient:		
General	2–28	2–150
Repairs	2–29	2–150
Reservoir, power steering:		
Draining	2–192*b*	2–299
Filling	2–192*c*	2–299
Installation	2–194*c*	2–302
Removal	2–194*a*	2–302
Replenish fluid	2–192*a*	2–299
Reverse gearbox, winch:		
Adjustment	2–261*a*	2–335
Installation	2–261*c*	2–336
Removal	2–261*b*	2–335
Roof locks, hinged, van	2–246*b*	2–327

	Paragraph	Page
Safety valve, air reservoir:		
Adjustment	2–166*c*	2–276
Installation	2–166*b*	2–276
Removal	2–166*a*	2–273
Screen, van window:		
Installation	2–240*b*	2–324
Removal	2–240*a*	2–324
Seal:		
Bilge pump outlet	2–272*b*	2–341
Sidegate:		
Installation	2–226*b*	2–319
Removal	2–226*a*	2–319
Tailgate:		
Installation	2–266*b*	2–338
Removal	2–226*a*	2–319
Sealed brake, rear axle:		
Installation	2–145*c*	2–250
Removal	2–145*b*	2–250
Seat belt kit:		
General	3–81	3–46
Parts list	3–86	3–47
Preventive-maintenance services	3–83	3–46
Replacement of components	3–85	3–47
Tabulated data	3–82	3–46
Troubleshooting	3–84	3–47
Selector, axle, transfer case	2–95*g*	2–215
Selector rods and linkages, transmission:		
Adjustment	2–132	2–239
Installation	2–131*b*	2–239
Removal	2–131*a*	2–238
Selector switch, headlight beam:		
Installation	2–113*b*	2–227
Removal	2–113*a*	2–227
Shock absorber:		
Installation	2–207*b*	2–310
Removal	2–207*a*	2–310
Slave kit:		
General	3–18	3–20
Installation	3–21	3–20
Removal	3–20	3–20
Tabulated data	3–19	3–20
Slave (Pershing) kit:		
General	3–22	3–21
Installation	3–26	3–22
Removal	3–24	3–22
Repair	3–25	3–22
Tabulated data	3–23	3–21
Soft top-to-machinegun mount adapter kit (M656 and XM757):		
General	3–61	3–38
Parts list	3–66	3–39
Preventive-maintenance services	3–64	3–39

	Paragraph	Page
Replacement of components	3–65	3–39
Service upon receipt of materiel	3–63	3–38
Tabulated data	3–62	3–38
Spark plug, manifold heater:		
Installation	2–68*b*	2–190
Removal	2–68*a*	2–190
Special purpose kits:		
Components, (*refer to specific kit*)		
Maintenance allocation	3–2	3–1
Service upon receipt of materiel	3–3	3–1
Special tools and equipment	2–7	2–3
Speedometer:		
Description	2–276	2–344
Replacement	2–94*b*	2–212
Springs, vehicle:		
Installation	2–204*b*	2–309
Removal	2–204*a*	2–308
Starter assembly:		
Description	2–85	2–204
Installation	2–90*b*	2–208
Removal	2–90*a*	2–208
Steering alinement	2–196	2–302
Steering arm:		
Description	2–144*a*	2–249
Installation	2–144*c*	2–250
Removal	2–144*b*	2–249
Steering gear:		
Service	2–191*b*	2–299
Worm preload adjustment	2–191*a*	2–299
Steering knuckle housing and boot:		
Description	2–147*a*	2–253
Installation	2–147*c*	2–254
Removal	2–147*b*	2–253
Steering linkage:		
Rod adjustment	2–187*c*	2–293
Rod end replacement	2–187*c*	2–293
Rod replacement	2–187	2–293
Steering wheel:		
Installation	2–190*b*	2–298
Removal	2–190*a*	2–298
Stowage box, windshield:		
Installation	2–224*b*	2–319
Removal	2–224*a*	2–319
Strainer:		
Bilge pump:		
Repair	2–272*a*	2–340
Replacement	2–272*a*	2–340
Primary fuel:		
Description	2–51*a*	2–176
Installation	2–51*d*	2–177
Removal	2–51*c*	2–177
Service	2–51*b*	2–177
Strap (webbing), spare tire:		
Installation	2–227*b*	2–319
Removal	2–227*a*	2–319
Studs, wheel hub:		
Installation	2–185*b*	2–292
Removal	2–185*a*	2–292
Supply manuals	A–2	
Switch:		
Bilge pump	2–95*d*	2–214
Flame, manifold heater	2–95*l*	2–217
Fuel cutoff	2–95*j*	2–216
Fuel selector	2–95*e*	2–214
Light (110-volt), van	2–253	2–330
Lights (vehicle)	2–95*c*	2–213
Low pressure warning	2–98*b*	2–220
Master (vehicle)	2–95*i*	2–215
Neutral start:		
Adjustment	2–98*a*	2–219
Replacement	2–98*a*	2–219
Pressurization control valve:		
(M656)	2–95*a*	2–213
(XM757 and XM791)	2–95*b*	2–213
Stoplight	2–98*c*	2–220
Truck-tractor protection control valve	2–95*f*	2–215
Tables:		
Table 2–1. Freezing points, composition, and specific gravities of military anti-freeze materials	2–1	2–1
Table 2–2. Special tools and equipment	2–7	2–3
Table 2–3. Preventive-maintenance checks and services	2–11	2–5
Table 2–4. Troubleshooting the vehicle	2–18	2–12
Table 2–5. Troubleshooting the electrical system	2–18	2–12
Battery system circuit		2–40
Bilge pump system		2–114
Direct signal system circuit		2–72
Fuel pump system circuits		2–102
Generating system circuit		2–54
Instruments, gages and horn system circuits		2–82
Lighting system circuit		2–62
Manifold heater and low pressure warning system		2–96
Starter system circuit		2–41
Trailer interconnecting cable and van connection system		2–112
Van body blackout relay system circuit		2–129
Van body system		2–119
Van body 24-volt system circuits		2–119
Van body 120/208-volt system circuits		2–123

	Paragraph	Page
Table 3-1. Preventive-maintenance checks and services for cold weather (−25°F.) kit equipped vehicles	3-7	3-2
Table 3-2. Troubleshooting the cold weather (−25°F.) kit	3-8	3-2
Table 3-3. Preventive-maintenance checks and services for the artic (−65°F.) kit	3-14	3-14
Table 3-4. Troubleshooting the artic, (−65°F.) kit	3-15	3-14
Table 3-5. Preventive-maintenance checks and services for the windshield defogging kit	3-30	3-23
Table 3-6. Troubleshooting the windshield defogging kit	3-31	3-25
Table 3-7. Preventive-maintenance checks and services for the 100-ampere alternator kit	3-37	3-28
Table 3-8. Troubleshooting the 100-ampere alternator kit	3-38	3-29
Table 3-9. Preventive-maintenance checks and services for the airbrake hand control kit	3-44	3-32
Table 3-10. Troubleshooting the airbrake hand control kit	3-45	3-33
Table 3-11. Preventive-maintenance checks and services for the machinegun mount kit	3-51	3-35
Table 3-12. Troubleshooting the machinegun mount kit	3-52	3-36
Table 3-13. Preventive-maintenance checks and services for the vehicle slinging kit	3-74	3-43
Tachometer:		
Description	2-276	2-344
Replacement	2-94*c*	2-212
Tailgate support kit (M656):		
General	3-77	3-45
Preventive-maintenance services	3-79	3-45
Support assembly:		
Installation	3-80*b*	3-45
Removal	3-80*a*	3-45
Tabulated data	3-78	3-45
Tapes, reflector (791)	2-271*c*	2-340
Thermostat, engine:		
Description	2-74*e*	2-194
Installation	2-83*c*	2-204
Removal	2-83*b*	2-203
Thermostat, transmission oil cooler:		
Installation	2-128*b*	2-237
Removal	2-128*a*	2-236
Throttle control rod, engine	2-95*h*	2-215
Throttle control to bellcrank rod	2-57*d*	2-181
Throttle valve control rod, transmission	2-57*e*	2-181
Tie rod, steering:		
Installation	2-188*b*	2-293
Removal	2-188*a*	2-293
Torque rods, axle:		
Lower rod replacement	2-208*a*	2-310
Upper rod replacement	2-208*b*	2-311
Towing pintle:		
Installation	2-199*b*	2-307
Removal	2-199*a*	2-307
Transfer case:		
Description	2-134	2-239
Installation	2-136*b*	2-241
Removal	2-136*a*	2-239
Service	2-135	2-239
Transmission:		
Installation	2-39	2-162
Removal	2-38	2-159
Transmitter: Engine coolant temperature	2-99*c*	2-221
Engine oil pressure	2-99*a*	2-221
Fuel level	2-99*b*	2-221
Transmission oil temperature	2-99*d*	2-222
Trap assembly, trailer brake:		
Installation	2-173*b*	2-284
Removal	2-173*a*	2-284
Treadle valve, vehicle brake:		
Assembly	2-171*c*	2-283
Disassembly	2-171*b*	2-283
Installation	2-171*d*	2-284
Removal	2-171*a*	2-283
Troubleshooting the electrical system:		
General	2-20	2-24
Low voltage test instructions	2-24	2-33
Multimeter instructions	2-25	2-38
Preliminary checks	2-26	2-39
Specific items and circuits (*See table 2-5*)		
System circuits	2-21	2-26
Test equipment	2-22	2-28
Use of test sets	2-23	2-32

Paragraph Page

- **Troubleshooting the vehicle:**
  - General 2-18 2-12
  - Procedures 2-19 2-13
  - Specific items (*See table 2-4*)
- Universal joints:
  - Vehicle propeller shafts 2-140 2-243
  - Winch propeller shafts:
    - Installation 2-263*b* 2-338
    - Removal 2-263*a* 2-337
- Valves:
  - Check, air reservoir 2-167 2-276
  - Control, handbrake 2-172 2-284
  - Control, windshield wiper 2-95 2-213
  - Cutoff, fuel solenoid 2-54 2-179
  - Protection, tractor-trailer 2-174 2-284
  - Quick release, bogie air manifold 2-175 2-286
- Safety, air reservoir 2-166 2-273
  - Treadle, vehicle brakes 2-171 2-283
- Vehicle:
  - Description 1-3 1-1
  - Difference in models 1-5 1-7
  - Dismantling for movement 2-5 2-2
  - Identification 1-4 1-1
  - Reinstallation after movement 2-6 2-2
  - Tabulated data 1-4 1-1
- Vehicle slinging kit:
  - General 3-71 3-43
  - Parts list 3-76 3-45
  - Preventive-maintenance services 3-74 3-43
  - Replacement of components:
    - Cable guide 3-75*a* 3-44
    - Retracting mechanism spring and clevis pin 3-75*b* 3-44
  - Service upon receipt of materiel 3-73 3-43
  - Tabulated data 3-72 3-43
- Water inlet tube, engine coolant:
  - Installation 2-78 2-201
  - Removal 2-77 2-200
- Water pump, engine:
  - Description 2-74*c* 2-194
  - Installation 2-82*c* 2-203
  - Removal 2-82*b* 2-203
- Wear pads, spring:
  - Installation 2-205*b* 2-310
  - Removal 2-205*a* 2-310
- Weatherstrip, panel:
  - Installation 2-243*b* 2-326
  - Removal 2-243*a* 2-326
- Wheel hub and spindle, rear axle:
  - Cleaning 2-148*c* 2-258
  - Description 2-148*a* 2-255
  - Installation 2-148*d* 2-258
  - Removal 2-148*b* 2-255
- Wheel spindle, rear axle:
  - Description 2-153*a* 2-264
  - Installation 2-153*c* 2-264
  - Removal 2-153*b* 2-264
- Wheel and tire:
  - Installation 2-184*b* 2-291
  - Removal 2-184*a* 2-291
- Winch and cable assembly:
  - Installation 2-257*c* 2-334
  - Removal 2-257*b* 2-332
  - Service 2-257*a* 2-332
- Windshield, cab:
  - Installation 2-221*b* 2-317
  - Removal 2-221*a* 2-317
- Windshield defogging kit:
  - General 3-27 3-23
  - Parts list 3-33 3-28
  - Preventive-maintenance services 3-30 3-23
  - Replacement of components:
    - Blower and diverter 3-32*c* 3-26
    - Blower motor assembly 3-32*d* 3-26
    - Blower switch assembly 3-32*e* 3-27
    - Electrical cable 3-32*a* 3-25
    - Hoses 3-32*b* 3-25
  - Service upon receipt of materiel 3-29 3-23
  - Tabulated data 3-28 3-23
  - Troubleshooting 3-31 3-25
- Wiper arm and blade:
  - Adjustment 2-268*c* 2-339
  - Installation 2-268*b* 2-338
  - Removal 2-268*a* 2-338
- Wiper motor, windshield:
  - Adjustment 2-269*c* 2-339
  - Installation 2-269*b* 2-339
  - Removal 2-269*a* 2-339
- Wiring, van electrical, 120-208 volt 2-248 2-328
- Wiring diagrams 2-27 2-129
- Wiring harness, engine manifold heater:
  - Installation 2-64*b* 2-189
  - Removal 2-64*a* 2-188
- Wiring harnesses and cables:
  - Chassis wiring harness repair 2-125*a* 2-235
  - Circuit identification 2-125*b* 2-235
  - Description 2-124 2-134
  - Lead circuit numbers 2-123*c* 2-233
  - Repair 2-123*b* 2-231

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-38, Organizational requirements for Truck, Cargo, 8×8, M656; Tractor, XM757; Van Expansible, XM791.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1990 O - 261-872 (21298)

PIN : 027156–000